Superfund Program

Proposed Plan **DRAFT - July 2015**
Allied Paper Landfill
Allied Paper/Portage Creek/Kalamazoo River Superfund Site – Operable Unit 1

INTRODUCTION

This Proposed Plan identifies the Preferred Alternative for cleaning up the contaminated material at Allied Paper Landfill (Allied Landfill), Operable Unit 1 (OU1) of the Allied Paper/Portage Creek/Kalamazoo River Superfund site, and provides the rationale for this preference. This Proposed Plan also includes summaries of other cleanup alternatives evaluated for use at the Allied Landfill, and provides basic information about the site. This document is issued by the U.S. Environmental Protection Agency (EPA), the lead agency for site activities. The Michigan Department of Environmental Quality (MDEQ) is the support agency. EPA, in consultation with MDEQ, will select a final remedy for Allied Landfill after it reviews and considers all information submitted during the 30-day public comment period which will run from *DATE* to *DATE*. EPA, in consultation with MDEQ, may modify the Preferred Alternative or select another response action presented in this Proposed Plan based on new information or public comments. Therefore, the public is encouraged to review and comment on all of the alternatives presented in this Proposed Plan. Members of the public are encouraged to attend and participate in a public meeting at *LOCATION* on *DATE/TIME*.

This Proposed Plan was developed in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This Proposed Plan relies on a risk-based method for polychlorinated biphenyls (PCBs) under the Toxic Substances Control Act (TSCA) and 40 C.F.R. §761.61(c).

EPA is issuing this Proposed Plan as part of its public participation responsibilities under §117(a) of CERCLA and §300.430(f)(2) of the NCP. This Proposed Plan summarizes information that can be found in greater detail in the Remedial Investigation (RI) and Feasibility Study (FS) reports and other documents contained in the Administrative Record. The Administrative Record file for this site can be found at the following locations:

Kalamazoo Public Library
315 South Rose
Kalamazoo, MI
(269) 342-9837 (call for hours)

EPA's Region 5 Records Center
77 West Jackson Boulevard
Chicago, IL 60604
Monday - Friday 8am-4pm (central time)
312-353-1063 (call for appointment)

EPA and MDEQ encourage the public to review the RI and FS reports and other documents in the Administrative Record to gain a more comprehensive understanding of the Allied Landfill and the Superfund activities that have been conducted at the site to date.

EPA is proposing that Alternative 2D be selected as the remedy for Allied Landfill. Alternative 2D involves excavating contaminated soils, sediments, and residuals from the Monarch area of the operable unit (OU) and from commercial and residential areas located around the periphery of the OU, and consolidating

those excavated materials into the main body of the landfill area of the OU. ~~Contaminated~~ Portions of the landfill and contaminated materials located along the periphery of the landfill area near Portage Creek and in wetlands adjacent to the landfill would also be consolidated into ~~the~~ a reduced footprint of the existing landfill area. The footprint waste area would be reduced from approximately 49 acres to approximately 27 acres. After consolidation, the landfill area would be covered with an impermeable cap and an active gas collection system would be installed. Excavated and backfilled areas, not a part of the flood zone, would be available for commercial/industrial redevelopment. The capped area would be available for light recreational reuse. Alternative 2D also includes long-term groundwater monitoring to verify the effectiveness of remedy, institutional controls to protect the remedy and restrict land and groundwater use, and long-term operation and maintenance (O&M). More details regarding the proposed alternative and the other alternatives that were considered are provided later in this Proposed Plan.

SITE BACKGROUND

The Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund site (referred to in this document as the site or the Kalamazoo River site) is located in Allegan and Kalamazoo counties in southwest Michigan. The site includes 80 miles of the Kalamazoo River, adjacent floodplains and wetlands, paper-residual disposal areas, and former paper mill properties, all pervasively contaminated with PCBs as the result of the recycling of carbonless copy paper. EPA listed the site on the National Priorities List in 1990 and the State of Michigan posted fish advisories warning against any consumption of certain Kalamazoo River fish within the site as early as 1977. The fish consumption advisories remain in effect.

Currently, the site is divided into the following operable units:

- OU1: Allied Landfill
- OU2: Willow Boulevard/A-Site Landfill
- OU3: King Highway Landfill
- OU4: 12th Street Landfill
- OU5: Kalamazoo River and Portage Creek
- OU7: Plainwell Mill

This Proposed Plan addresses OU1, Allied Landfill, which is located within the City of Kalamazoo, Michigan. The Allied Landfill OU is defined as the areas between Cork Street and Alcott Street where contamination from paper operations is located (see Figure 1). Cork Street forms the southern boundary of the OU, and Alcott Street runs along the northern boundary. Portage Creek runs through the property, bisecting the OU. Allied Landfill includes areas that are zoned for residential, commercial, and manufacturing uses. Residential development exists along a portion of the eastern side of the OU, and a railroad corridor forms a portion of the western boundary. Commercial and manufacturing properties are located north and south of Allied Landfill and along portions of the eastern and western sides of the property.

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The key risk management goals established for Allied Landfill are associated with exposure to PCBs in soils and sediments. Paper mills were located on or near the Allied Landfill beginning at least as early as the 1870s. From at least the 1950s through the 1970s, those mills recycled carbonless copy paper that contained PCBs as a carrier for the ink. Wastewater generated in that process was contaminated with PCBs, which adsorbed or adhered to suspended particles such as cellulose and clay in the wastewater.

Paper mills associated with OU1 include mills referred to as the Bryant Mill and the Monarch Mill, both of which were owned and operated by various companies at different times. Millennium Holdings was the successor to those companies. The Bryant Mill was located on the northern part of OU1 while

the Monarch Mill was located east and south of Portage Creek. These mills included carbonless copy paper recycling in their operations.

The mills either discharged the contaminated wastewater directly to Portage Creek or first dewatered the wastewater in settling lagoons, intended to remove some of the particles, prior to discharge. Settling lagoons were located at areas of OU1 now referred to as the Bryant Historic Residuals Dewatering Lagoon (HRDL) and Former Residuals Dewatering Lagoons (FRDLs), the Monarch HRDL, and the Former Bryant Mill Pond, all of which are shown in Figure 2.

The Bryant Mill Pond was formed by the damming of Portage Creek at Alcott Street, impounding the creek within the northern part of the OU. The Alcott Street Dam was built in 1895 to provide hydroelectric power and to control water for the Bryant Paper Mills. The RI report for Allied Landfill, completed by MDEQ in 2008, discusses the Bryant Mill Pond in greater detail. In 1976, Allied Paper Company obtained a permit from the Michigan Department of Natural Resources to draw down the reservoir in an effort to reduce contamination impacts through discharge of sediment or groundwater to Portage Creek. Surface water in Portage Creek was lowered 13 feet during the drawdown, which exposed sediments that had accumulated over the many years of mill operations.

Allied Landfill Subareas

In addition to the areas described above, additional areas have come to be contaminated due to site operations. For purposes of managing the Allied Landfill, EPA has organized the contaminated areas into the following areas and subareas, as depicted in Figure 2:

- **Former Operational Areas**— Consists of Bryant HRDL and FRDLs, Monarch HRDL (including the Former Raceway Channel), Former Type III Landfill, and the Western Disposal Area. PCBs were introduced to the HRDL and FRDLs through the residual dewatering operations. At times, contaminated residuals from these areas were excavated and disposed of in the Western Disposal Area and the Type III Landfill. Portions of contiguous properties, including the adjacent Panelyte Marsh, Panelyte Property, Conrail Railroad Property, and the State of Michigan's Cork Street Property, are included in the Former Operational Areas as a result of waste materials that have encroached into these areas from the Western Disposal Area.
- **Former Bryant Mill Pond Area**—Includes the area within the boundary of the Former Bryant Mill Pond, defined by a historical impoundment elevation of 790 feet above mean sea level (AMSL). A portion of the Bryant Mill property south of Alcott Street is included within the area. During operations, the Pond was contaminated through discharge of contaminated wastewater.
- **Residential Properties (Outlying)**—Residential Properties that are part of the site but are not contiguous with the Former Operational Areas include the following: Clay Seam Area, East Bank Area, four adjacent residential properties (Golden Age Retirement Community and three single-family residences), and property owned by the Lyondell Trust (formerly Millennium Holdings LLC or MHLLC) but used by owners of the three single-family residences. These properties are adjacent to the Former Bryant Mill Pond area and were contaminated by its use and flooding.
- **Commercial Properties (Outlying)**—Commercial properties that are part of the site but are not contiguous with the Former Operational Areas include the Goodwill property, Consumers Power, Former Filter Plant and Alcott Street Parking Lot (both owned by the Lyondell Trust [formerly MHLLC])), and the former Bryant Mill property. These properties are adjacent to the Former Bryant Mill Pond area and were contaminated by its use and flooding.

Prior Response Actions

Allied Landfill was designated as a distinct OU within the Kalamazoo River site, in part so cleanup activities could proceed on a separate schedule relative to the remedial activities developed for the other OUs. Between 1998 and 2004, a series of actions – the first cleanup actions at the Kalamazoo River site – were completed at the Allied Landfill OU to stop the ongoing release of contamination from the Former Bryant Mill Pond to Portage Creek and the Kalamazoo River. These actions minimized exposure potential and addressed the largest source of PCB contamination to Portage Creek and the Kalamazoo River by excavating the contaminated materials from the former mill pond and consolidating and capping those materials in the Allied Landfill. The primary actions performed to date are summarized below.

Time-critical Removal Action at the Former Bryant Mill Pond

EPA completed a time-critical removal action (TCRA) at the Former Bryant Mill Pond in 1998 and 1999. The work involved the excavation of 146,000 cubic yards (yd^3) of PCB-containing sediments, residuals, and soils and placement of the materials into the Bryant HRDL and FRDLs. EPA performed the excavation in segments by using stream diversions to expose the sediment and excavate in dry conditions. After excavation, EPA collected confirmation samples, backfilled the area, and then removed the stream diversions.

The TCRA was successful in removing a large ongoing source of PCB contamination to Portage Creek and the Kalamazoo River. Specifically, the TCRA involved excavating the PCB-contaminated residuals from the Former Bryant Mill Pond up to an elevation of 790 feet AMSL. EPA's action level for the excavation was a PCB concentration of 10 milligrams per kilogram (mg/kg), with a goal of achieving post-excavation PCB concentrations less than or equal to 1 mg/kg. EPA then backfilled the excavated area with an amount of clean fill approximately equal to the volume of materials removed. The thickness of the backfill layer ranged from approximately 1 foot at the upstream end of the Former Bryant Mill Pond to approximately 10 feet near the Alcott Street Dam. EPA graded, seeded, and revegetated the backfilled area with native grasses and plants.

The post-excavation samples EPA collected from the final excavation were equal to or less than the target PCB concentration of 1 mg/kg established for the TCRA in 435 of the 440 samples that were collected. The PCB concentration in the remaining five samples ranged from 1.8 mg/kg to 3.8 mg/kg. Additionally, 410 of the 440 final post-excavation samples were below the 0.33 mg/kg screening-level criterion protective of people eating fish recommended by MDEQ in the RI report.

PCBs were the driver for the removal action at the Former Bryant Mill Pond. Confirmation samples were not collected for other contaminants of concern (COCs) that were identified in the RI. However, the RI report identified the expectation that the other COCs are co-located with the PCB residuals, and that addressing the PCB contamination is expected to address the other COCs found at Allied Landfill. Additionally, during the TCRA at the Former Bryant Mill Pond, excavated areas were backfilled with 1 to 10 feet of clean fill and restored with native vegetation, thereby reducing the risk of direct dermal contact and erosion to Portage Creek of any other potential COCs that may have remained in the excavated areas. EPA evaluated the completeness of the TCRA in the FS during the development of the remedial alternatives and consideration of institutional controls.

Interim Response Measures

MHLLC conducted a series of small-scale Interim Response Measure (IRM) activities to restrict access to Allied Landfill and to provide erosion control and stabilization in certain areas. This work began in the early to middle 1990s. Additionally, MHLLC removed remnant structures, such as the Filter Plant, from the historical mill operational areas during this time period. The former Bryant Clarifier remains in place (see Figure 2).

MHLLC carried out IRM activities to stabilize the Bryant HRDL and FRDLs after completion of the Bryant Mill Pond TCRA. The measures served to further mitigate the exposure to or transport of PCBs at Allied Landfill. The IRM activities completed at the Bryant HRDL/FRDLs are summarized briefly as follows and described in detail in the RI report:

- Installation of sealed-joint sheet pile along the Bryant HRDL and FRDLs adjacent to Portage Creek to stabilize the perimeter berms that separate the materials in the Bryant HRDL and FRDLs from the Portage Creek floodplain. The location of the sheet pile wall is shown in Figure 2. This interim response action was completed in 2001.
- Removal of several hundred cubic yards of soil containing residuals from locations between the sheet pile wall and Portage Creek and consolidation of those materials into the Bryant HRDL and FRDLs. The material was removed in 2000 and 2003 to minimize the potential for contaminated material releases to Portage Creek.
- Construction of an engineered composite cap for the Bryant HRDL and FRDLs, with its design based on Michigan Act 451, Part 115, solid waste regulations. The cap, which covers the Bryant HRDL and FRDLs, was constructed between 2000 and 2004. MDEQ expressed concerns that the flexible-membrane liner (FML) was left exposed for substantial periods of time. MHLLC subsequently repaired the cap, rather than replacing it as recommended, to address MDEQ concerns. MDEQ remains concerned about the current cap due to the number and quality of the repairs that were made.
- Installation and operation of a groundwater extraction system inside the sheet pile wall and beneath the cap. The purpose of the system was to mitigate groundwater mounding behind the sheet pile wall, which might compromise the cap or inundate otherwise unsaturated residuals and increase the potential for migration of PCBs to the creek.

In 2002, MHLLC also removed approximately 1,700 yd^3 of residuals located in the floodplain on the eastern side of Portage Creek (referred to as the East Bank Area, shown in Figure 2) and PCB-containing soils between the sheet pile wall and the creek as a 2002 IRM. The materials were consolidated into the Bryant FRDLs prior to construction of the landfill cap.

The cap was installed to act as a barrier to minimize the potential for direct contact; however, as noted above, the FML was left uncovered for an extended period and may not be fully mitigating the infiltration of precipitation that might form leachate.

The IRM methods and cleanup targets were similar to those used by EPA during the Former Bryant Mill Pond TCRA. Results of all post-excavation confirmation samples were below the target PCB removal action goal of 1 mg/kg, and the excavation was backfilled with a minimum of 1 foot of clean fill. The area was subsequently seeded and revegetated with native plants.

During the IRM actions described above, confirmation sampling showed that MHLLC removed residuals exceeding 1 mg/kg. PCB concentrations greater than 1 mg/kg exist in areas of the floodplain not addressed by the IRM activities, specifically the seep areas. These areas will be addressed by this proposed remedy.

Public Outreach to Date

EPA has conducted extensive public outreach on Allied Landfill. Since, 2007, EPA has provided updates to the public at site-wide public meetings that are conducted on a quarterly to semi-annual basis. EPA has also held public meetings specifically about Allied Landfill, including two presentations on the FS by the responsible party, MHLLC, in fall 2009, prior to their bankruptcy. In January 2011, EPA presented the array of cleanup alternatives to the public. In 2013, EPA conducted four Allied Landfill tours, the first for the mayor of Kalamazoo, followed by three additional tours for citizen groups prior to publishing the FS in November 2013. ~~Most recently, EPA held~~EPA presented the FS in two open-house style meetings, one in February 2014 and another in April 2014. To this point, the city of Kalamazoo had made statements that total removal of the waste was the only cleanup plan that they would support.

Starting in April 2014, EPA began meeting with the city of Kalamazoo and MDEQ with the goal of developing of a new cleanup alternative that might be added to the FS by addendum. The city of Kalamazoo shared the results of the meetings via a December 2014 press release and a February 2015 public meeting. Their message was that total removal of the waste may not be viable and that they could support a consolidation and capping alternative that maximizes reusable space. EPA shared the new alternative with the public in draft from during an April 2015 meeting and in final form at a June 2015 availability session/public meeting.

SITE CHARACTERISTICS

Allied Landfill occupies 89 acres, including Portage Creek, between Cork and Alcott Streets within the City of Kalamazoo. In 2008, MDEQ concluded an RI, which it summarized in a 2008 RI report. Upon finalization of the RI report, EPA assumed the lead agency role for the remainder of the work to be done at Allied Landfill. Significant findings from the RI are discussed below.

Geology/Hydrogeology

Allied Landfill is situated on the floor of a north-south trending valley drained by Portage Creek. The creek flows northward, emptying into the Kalamazoo River about 2.25 miles to the north. As shown below, the valley is flanked by hills formed of unconsolidated material that rise about 80 feet above creek level to the east and 100 feet above creek level to the west. The graphic below and Figure 3 depict the general topography of the Allied Landfill OU and its environs. Total relief across the site is about 70 feet, with elevations ranging from about 783 feet AMSL at the downstream end of Portage Creek (near the Alcott Street Dam) to about 853 feet AMSL at the highest point of the Monarch HRDL. The land surface of the Allied OU generally slopes toward Portage Creek.

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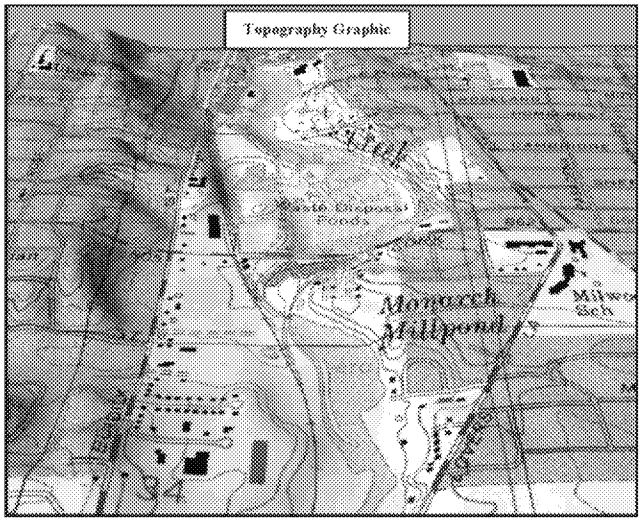

Surface runoff at Allied Landfill is generally directed to Portage Creek. Runoff from the area capped during the IRM (i.e., the Bryant HRDL and FRDLs) is currently managed through a series of engineered drainage ditches and swales, routed to a settling basin, and discharged to Portage Creek through an engineered outlet.

Geology

The geologic layers in the vicinity of the site generally consist of bedrock overlain by overburden. The bedrock underlying the region near the Allied OU consists of the Coldwater Shale formation. The surface of the formation, which near the site is estimated at an elevation of 650 to 700 feet AMSL, slopes downward to the southwest. The formation is greater than 500 feet thick, with bedding dipping toward the northeast. Based on the elevation range provided above, the depth to bedrock beneath the site is estimated to be between 100 and 150 feet.

Classified overburden soils in the region fall primarily into the Oshtemo-Kalamazoo-Glendora complex. The ~~map~~ geologic units range from nearly level areas of very poorly drained Glendora soil along Portage Creek to rolling, well-drained areas of Kalamazoo soil and hilly, well-drained deposits of Oshtemo soil on the upland areas. The Glendora series consists of very poorly drained soils on flood plains along perennial rivers and streams. The soils formed in sandy alluvium. Layers of this soil are highly variable in sequence and thickness within a horizontal distance of a few feet.

Seven units were identified in the upper sand and gravel aquifer at the Allied OU based on investigatory borings. The units include fill, residuals, peat, sand and gravel, silt, clay, and till. Fill and residuals are not native layers but are the result of site activities. Based on slug test data, the hydraulic conductivity of the upper sand unit varies considerably across the site, ranging between $1.7x10^{-2}$ to $4.9x10^{-5}$ centimeters per second (cm/s). As with most clays, the residuals have low permeability when compacted. Based on the results of 10 residuals samples collected from OU1, the measured hydraulic conductivity was approximately 1.3×10^{-7} cm/s.

Figures 4 and 5 identify the locations of representative geologic cross sections of the Allied Landfill. Figure 6 is cross section B"-B-B'-B"' which runs north-south from the City well field through the Allied OU, as shown on Figure 4. Figure 5 shows the location of two cross sections, B-B' and F-F', which run generally east-west through the landfill; these cross sections are provided in Figure 7 and Figure 8, respectively.

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Hydrogeology

Based on monitoring well data collected during the RI and water samples collected in the clarifying unit of the currently operating groundwater collection system, EPA believes that impacted groundwater at Allied Landfill does not pose a risk outside of the waste. The City of Kalamazoo has raised concerns that contamination from Allied Landfill could migrate to the City well field. In 2009, MHLLC completed a Supplemental Groundwater Study to evaluate whether this pathway exists.

The Supplemental Groundwater Study included an evaluation of existing data from Allied Landfill, the nearby Strebor facility, and the City wellhead protection model, and also included the collection of a new round of groundwater elevation data. This additional round of groundwater elevations included a comprehensive network of wells from Allied Landfill and the Strebor, Panelyte, and Performance Paper properties, with data collected from all wells concurrently for the first time.

The groundwater elevation data supported the conceptual understanding of the following:

- Water is not dropping down to the elevation of the city wells, as there is an upward gradient from the lower regional aquifer upward toward the surficial aquifer.
- Shallow groundwater flow in the area is to the east and not northwest toward the City's Central Well Field. Shallow groundwater from adjacent properties flows to the east and west onto Allied Landfill.

- Portage Creek is the point of discharge for shallow groundwater from Allied Landfill, further directing groundwater away from the City Central Well Field.
- All available data suggest that a flow path from Allied Landfill toward the City's Central Well Field is unlikely. This conclusion is based on the presence of a lateral aquitard (the previously mentioned clay layer) beneath portions of Allied Landfill and an upward vertical hydraulic gradient between the regional aquifer (used by the City for potable purposes) and the shallow aquifer.

Further empirical support for the above conceptual understanding was provided by the analytical results from water samples collected by the City from its own production wells. There have never been detections of PCBs in the City's samples, even at trace levels.

The results of the Supplemental Groundwater Study support the conceptual site model for OU1, and specifically the conclusion that there is not a groundwater migration pathway from Allied Landfill to the City's Central Well Field. The complete Supplemental Groundwater Study report is included as Appendix A to the FS report for the Allied Landfill OU.

MDEQ generally concurred with the study's conclusions in an April 16, 2010, letter to EPA, in which MDEQ stated the following:

- Portage Creek appears to be the primary influence on the configuration of the water table surface within Allied Landfill. In the main disposal area of Allied Landfill, shallow groundwater discharges radially to Portage Creek.
- Shallow groundwater is influenced, although not completely captured, by the creek.
- Due to the upward pressure exerted by the groundwater present in the regional aquifer, the downward flow of groundwater from the surficial aquifer monitored at Allied Landfill to the deeper regional aquifer is highly improbable.

Various data collected over time illustrate hydraulic disconnection between the surficial aquifer unit and the regional aquifer unit.

Nature and Extent of Contamination

Early investigative efforts recognized that if the full extent of PCBs were identified and appropriately remediated, then other associated substances at Allied Landfill would be appropriately addressed. The RI therefore focused on PCBs for identifying the extent of contamination. In addition to PCBs, several inorganics, volatile organic compounds (VOCs), and semivolatile organic compounds (SVOCs) were detected in soils, sediments, and groundwater. The RI report concluded the following:

- Target analyte list (TAL) inorganic constituents in soils and sediments that exceed criteria appear to be associated with the PCBs identified at Allied Landfill.
- Soils with inorganic constituents may be acting as a source, resulting in low-level impacts to the groundwater.
- Target compound list (TCL) VOCs in soils, sediments and groundwater do not appear to be associated with contaminant impact identified at Allied Landfill. Detected TCL SVOCs in soils and sediments appear to have a similar distribution to the contaminant impact based on the data set available.

- The groundwater impact of detected SVOCs appears to be much less extensive than the SVOCs in soil at Allied Landfill. There were no SVOC exceedances of the screening criteria in the most recent groundwater sampling event.
- Concentrations of TCL pesticides did not exceed screening criteria.
- TCL pesticides were not present in the groundwater at the time of sampling, which is consistent with the soil and sediment data. One pesticide was detected in a leachate sample below screening criteria, but no exceedances were identified.
- Soils with visual indicators of paper residuals can be expected to have PCB concentrations.
- During the most recent sampling, PCBs were detected in several of the groundwater seep monitoring wells located along Portage Creek near the Former Operational Areas, with PCB detections above the groundwater-surface water interface (GSI) screening criteria in two locations.

PCBs are the primary contaminant of concern and therefore are being used as the primary indicator to define the extent of contamination at Allied Landfill. PCBs are associated with the residuals, having entered the waste stream during the recycling of carbonless copy paper, and appear to be the most widespread contaminant at Allied Landfill. As previously stated, most other COCs (inorganics and SVOCs) appear to be collocated with PCBs in the various media. PCBs at Allied Landfill are widespread. They are present in the residuals, soils, and sediments as a result of the residuals eroding and mixing into the soils and/or sediments near or at the ground surface in certain subareas of Allied Landfill, including the Monarch HRDL and Western disposal area.

The red dots on Figure 9 and Figure 10 depict the aerial extent of PCB-containing soils and residuals at the surface and subsurface, respectively, at the Allied Landfill OU. PCBs are present in concentrations exceeding TSCA and Michigan Part 201 risk-based screening levels in the following areas: the soils and sediments in the Former Operational Areas, the area of the Former Bryant Mill Pond impacted by ongoing seeps, certain Residential Areas east of the former Allied Paper property, and certain neighboring Commercial Areas; in groundwater in the Western Disposal Area and Bryant HRDL/FRDLs; and in seeps in the Former Type III Landfill Area adjacent to the Bryant HRDL/FRDLs. The PCB detections in groundwater (3 of 56 monitoring well locations) and seeps (2 of 20 seep locations) were all co-located within or adjacent to borings that contained residuals. Thus, EPA does not believe there is a groundwater plume of PCBs emanating from Allied Landfill.

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Although PCBs are found in the landfill at concentrations up to 2,500 mg/kg, EPA does not consider these wastes to constitute a source material, or principal threat, that requires treatment to reduce the toxicity or mobility or the waste. Because the waste materials exhibit very low mobility and can be reliably controlled in place through consolidation and capping, EPA does not consider the waste materials at Allied Landfill to be principal threat waste. Soil and groundwater data demonstrate that the PCBs at Allied Landfill are not mobile within the waste and do not readily leach into groundwater. Therefore, the PCB contamination at Allied Landfill can be reliably controlled in place.

The highest exposure that is reasonably expected to occur at a site but that is still within the range of possible exposures is referred to as the reasonable maximum exposure (RME). While sample results at the Allied Landfill show isolated areas of PCBs with concentrations as high as 2,500 mg/kg, the RME for the soils and sediments at the Allied Landfill is 60 mg/kg. This calculation is based upon the 95% confidence limit on the mean PCB concentration in soil, sediment, and residual samples from Allied Landfill.

Fate and Transport

The following PCB fate and transport mechanisms were evaluated at Allied Landfill:

- PCB transport from surface water runoff and soil erosion
- PCB transport in groundwater
- PCB transport in Portage Creek
- PCB transport in air

In general, PCBs are relatively immobile. They are chemically and thermally stable, fairly inert, have low solubility in water, and have a high affinity for solids, making them strongly adhere to the paper residuals at Allied Landfill. Typically, the lower the water solubility of a chemical, the more likely it is to be adsorbed onto solids. Adsorption properties are generally characterized by an organic carbon partitioning coefficient denoted by Koc. The Koc values for PCBs are relatively high, which means that PCBs readily adsorb to organic material in media such as sediments and soils. The octanol water partitioning coefficient, Kow, is a measure of a chemical's solubility in water. The coefficient is the ratio of the concentration of a chemical in octanol over the concentration of the chemical in water. PCBs tend to have a high Kow value, indicating they are not very soluble in water. Taken together, the combination of low water solubility (high Kow) and high adsorption tendency (high Koc) indicates that PCBs have a strong affinity for soils and suspended solids, especially those high in total organic carbon.

In addition to organic content, other soil or sediment characteristics affect the mobility of PCBs. These include soil density, particle size distribution, moisture content, and permeability. Also, meteorological and physical conditions such as amount of precipitation and the presence of organic colloids (micron-sized particles) can also affect the mobility of PCBs in the environment. PCBs that are dissolved or sorbed to mobile particulates (for example, colloids) may also migrate with groundwater in sediments and soils.

The PCBs at Allied Landfill do not readily migrate out of the paper residuals. The residuals at Allied Landfill are composed primarily of fibrous wood material and clay. PCBs have a high affinity for the residuals due to the high organic content of the residuals. When compacted, the residuals have a low hydraulic conductivity. The hydraulic conductivity of 10 residuals samples collected from Allied Landfill was approximately 1.3×10^{-7} cm/s. As water does not easily flow through the residuals, the opportunities for PCBs to migrate via groundwater are low.

Based on the combined effects of the PCBs' high affinity to adhere to the residuals and low hydraulic conductivity, the PCBs do not migrate significantly from the residual material. This finding is supported by the near absence of PCB detections in groundwater samples at the Allied Landfill OU.

Surface Water Runoff and Soil Erosion

There are portions of Allied Landfill (primarily in the Former Operational Areas) where PCBs and other COCs are present in surface soils and surface residuals and therefore exposed to the elements. Because these materials are located at the surface, they may be transported to the floodplain or sediments in Portage Creek by erosion or surface water runoff.

Groundwater

PCBs do not appear to be migrating in groundwater beyond the waste areas at the former Allied Paper property. PCBs were detected in 3 of 56 monitoring well locations and 2 of 20 seep locations. Exceedances of groundwater criteria occurred only in wells screened within or immediately adjacent to the residuals. This finding supports the conclusion that PCB transport in groundwater is limited within the landfill.

Direct Discharge to Portage Creek

The most significant historical source of PCBs to Portage Creek from Allied Landfill was the discharge of PCB-containing residuals at the Former Bryant Mill Pond. The excavation of PCB-containing sediments, residuals, and soils from the Former Bryant Mill Pond and subsequent replacement with clean fill, and the consolidation and capping of those materials in the main body of the landfill, has isolated those source materials from direct contact with surface water and removed the largest source of PCBs to Portage Creek. Under current conditions, the remaining potential sources of PCBs to Portage Creek from Allied Landfill are primarily associated with the erosion of contaminated soils and sediments.

Air

Transport of PCBs by air can occur through wind-blown dispersion or volatilization from exposed residuals. An investigation for vapor-phase and particulate-phase PCBs was performed in 1993, when the waste materials in the landfill were not covered by a cap. PCBs were not detected in any of the airborne particulate-phase samples collected at the Allied Landfill OU. Vapor phase PCB concentrations were detected within the OU1 site boundary above the background concentrations, but did not exceed criteria. The subsequent completion of the TCRA and IRM activities significantly reduced the area where residuals were exposed at the ground surface, so PCB concentrations in the air are expected to have decreased. Air is not anticipated to be a significant transport mechanism at the site.

SCOPE AND ROLE OF OPERABLE UNIT OR RESPONSE ACTION

As noted earlier, a TCRA was conducted at OU1 in 1998-1999 to address the Former Bryant Mill Pond area of the Allied Landfill OU, and a series of IRM activities was conducted in the 1990s and early 2000s to restrict site access and stabilize the OU. The proposed response action in this Proposed Plan is intended to be the final response action for the Allied Landfill OU. The other OUs of the Kalamazoo River site have been or will be addressed by separate response actions.

SUMMARY OF SITE RISKS

Exposure to PCBs is the primary risk driver at Allied Landfill. MDEQ, as part of its RI activities, completed a *Site-wide Final (Revised) Human Health Risk Assessment* (HHRA) and *Final (Revised) Baseline Ecological Risk Assessment* (BERA) for the Kalamazoo River site in 2003.

The HHRA quantitatively identified potential carcinogenic and non-carcinogenic risks to human health through exposure to media impacted with PCBs, including:

- consumption of fish by recreational and subsistence anglers
- direct contact with PCB-contaminated materials by residents, recreational users, and construction/utility workers
- inhalation of dust and volatile emissions from PCB-contaminated materials

As evidenced by the bulleted items above, the HHRA included an assessment of a variety of land use assumptions, potential receptors, and exposure pathways, including residential scenarios, recreational scenarios, and worker scenarios. Although the HHRA was not conducted specifically for OU1, the assumptions made and the scenarios evaluated apply equally to OU1 and to other OUs of the Kalamazoo River site.

The BERA quantitatively identified potential risks to various ecological receptors for different exposure pathways:

- direct contact with and ingestion of PCB-contaminated soils, sediments, or paper residuals by animals at Allied Landfill
- ingestion of PCB-contaminated animals by other animals

In the BERA, the mink (aquatic) and robin (terrestrial) were used to represent ecological receptors.

The PCB-contaminated soils, sediments, and exposed paper residuals at OU1 present a human health risk via the direct contact exposure pathway and an ecological risk via direct contact and ingestion pathways. Exposed soils, sediments and paper residuals currently act as a source to Portage Creek via erosion and may result in increased aquatic risk. Additionally, there are active groundwater seeps at OU1 that discharge low levels of PCBs to Portage Creek, likely through the transport of contaminated solids that the seep liquids encounter as they express. The greatest aquatic risk is to fish, which may consume contaminated sediments, and subsistence anglers that consume these fish.

Although groundwater concentrations within the boundaries of the waste material exceed Preliminary Remediation Goals (PRGs), PCBs have not been detected in groundwater beyond the landfill boundary. For this reason, EPA does not believe that the contamination at Allied Landfill poses a significant risk to groundwater. In addition, the shallow aquifer is not utilized for drinking water purposes and zoning requires all new facilities to receive drinking water from the City of Kalamazoo's water supply.

More details about the risks to human and ecological receptors at the site are provided in the Allied Landfill FS Report and the site-wide HHRA and BERA. During the FS, EPA developed and evaluated alternatives to mitigate the risks posed by the Allied Landfill OU. Those alternatives are described in later sections of this Proposed Plan.

As noted earlier, other potential COCs have been identified at Allied Landfill and will need to be considered with PCBs during the remedial action. EPA has concluded that identification and appropriate remediation of PCBs will mean that the other associated COCs would also be addressed. Similarly, the risk assessments conducted by MDEQ focused on PCBs as the risk driver.

The PRGs established by EPA for the PCBs at the Allied Landfill OU are summarized in Table 1. For contaminants other than PCBs, EPA adopted updated Michigan Act 451, Part 201, screening criteria and federal drinking water maximum contaminant levels (MCLs) as the PRGs. The PRGs and exposure routes for COCs other than PCBs are shown in Table 2. A summary of the frequency of PRG exceedances for COCs other than PCBs is provided in Table 3.

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Basis for Taking Action

It is EPA's current judgment that the Preferred Alternative identified in this Proposed Plan, or one of the other active measures considered in the Proposed Plan, is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

REMEDIAL ACTION OBJECTIVES

Remedial Action Objectives (RAOs) are general descriptions of the goals to be accomplished through cleanup activities. RAOs are established by considering/evaluating the medium of concern, COCs, allowable risk levels, potential exposure routes, and potential receptors. EPA has identified the following RAOs to address the risks posed by the Allied Landfill OU:

- RAO1: Mitigate the potential for human and ecological exposure to materials at Allied Landfill containing COC concentrations that exceed applicable risk-based cleanup criteria.
- RAO2: Mitigate the potential for COC-containing materials to migrate, by erosion or surface water runoff, into Portage Creek or onto adjacent properties.
- RAO3: Prevent contaminated waste material at the Allied Landfill from impacting groundwater and surface water.

EPA developed PRGs for the Allied Landfill OU based on potential exposure pathways, risk assessments, and federal and state applicable or relevant and appropriate requirements (ARARs). The PRGs for PCBs are included in Table 1. The PRGs for COCs other than PCBs are shown in Table 2.

In addition to the quantitative PRGs identified, EPA also recommends that a qualitative performance standard be established requiring either (a) remedial actions where residuals are visually observed or (b) sufficient sampling to verify that the residuals do not contain PCB concentrations above the applicable PRGs.

SUMMARY OF REMEDIAL ALTERNATIVES

EPA developed different remedial alternatives to address the potential risks at the Allied Landfill OU. EPA is required to evaluate a "No Action" alternative as a basis of comparison for the other alternatives. In EPA's judgment, the Preferred Alternative (Alternative 2B) identified in this Proposed Plan, or one of the other active remedial alternatives considered in the Proposed Plan, is necessary to protect public health, welfare, and/or the environment from actual or threatened releases of hazardous substances into the environment from OU1. The remedial alternatives that were evaluated in the FS, along with their major components, are listed below. A more detailed description of each alternative is provided later in this section of the Proposed Plan.

Alternative 1—No Further Action

- No implementation time required
- Net present value cost of $120,000

Alternative 2A—Consolidation of Outlying Areas on the Bryant HRDL/FRDLs, Former Type III Landfill, and Western Disposal Area. This alternative includes the following major components:

- Excavate Outlying Areas and certain Operational Subareas (see *Common Elements* discussion below for more details)
- Excavate and pull back perimeter around Bryant HRDL/FRDLs, Former Type III Landfill, and Western Disposal Area
- Excavate and pull back creek-side edge of Monarch HRDL to achieve non-residential soil PRG of 10 mg/kg PCBs; where hydraulically connected to Portage Creek, set-back areas would achieve 0.33 mg/kg sediment PRG for PCBs to be protective of human consumption of fish
- Consolidate excavated material on the Bryant HRDL/FRDLs, Former Type III Landfill, and Western Disposal Area

- Install cap on Bryant HRDL/FRDLs, Former Type III Landfill, Western Disposal Area, and Monarch HRDL
- Implement restrictive covenant to limit use in commercial areas
- Implement restrictive covenant in capped areas to prohibit interference with the cap and fences and to prohibit groundwater use
- Restore wetlands and implement restrictive covenant to maintain wetland areas.
- Monitor groundwater to verify effectiveness of remedy
- Implementation time: 2 years
- Net present value cost of $43,000,000

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Alternative 2B—Consolidation of Outlying Areas and Monarch HRDL on the Bryant HRDL/FRDLs, Former Type III Landfill, and Western Disposal Area. This alternative includes the following major components:

- Excavate Outlying Areas and certain Operational Subareas (See *Common Elements* discussion below for more details)
- Excavate Monarch HRDL to achieve non-residential soil PRG of 10 mg/kg PCBs; areas hydraulically connected to Portage Creek would achieve 0.33 mg/kg sediment PRG for PCBs to be protective of human consumption of fish
- Excavate and pull back perimeter around Bryant HRDL/FRDLs, Former Type III Landfill, and Western Disposal Area
- Consolidate excavated material on the Bryant HRDL/FRDLs, Former Type III Landfill, and Western Disposal Area
- Install cap on Bryant HRDL/FRDLs, Former Type III Landfill, and Western Disposal Area
- Implement restrictive covenant to limit use in commercial areas
- Implement restrictive covenant in capped areas to prohibit interference with the cap and fences and to prohibit groundwater use
- Restore wetlands and implement restrictive covenant to maintain wetland areas
- Monitor groundwater to verify effectiveness of remedy
- Implementation time: 2 years
- Net present value cost of $41,000,000

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Alternative 2C—Consolidation of materials from Outlying Areas and Monarch HRDL with PCB concentrations of 500 mg/kg or less on the Bryant HRDL/FRDLs, Former Type III Landfill, and Western Disposal Area, and off-site incineration of excavated soils/sediments with PCB concentrations greater than 500 mg/kg. This alternative includes the following major components:

- Excavate Outlying Areas and certain Operational Subareas (See *Common Elements* discussion below for more details)
- Excavate Monarch HRDL to achieve non-residential soil PRG of 10 mg/kg PCBs; areas hydraulically connected to Portage Creek would achieve 0.33 mg/kg sediment PRG for PCBs to be protective of human consumption of fish
- Excavate and pull back perimeter around Bryant HRDL/FRDLs, Former Type III Landfill, and Western Disposal Area
- Transport off site for incineration all excavated materials with PCB concentrations greater than 500 mg/kg
- Consolidate excavated materials with PCB concentrations of 500 mg/kg or less on Bryant HRDL/FRDLs, Former Type III Landfill, and Western Disposal Area
- Install cap on Bryant HRDL/FRDLs, Former Type III Landfill, and Western Disposal Area
- NEED BULLET HERE ABOUT IMPLEMENTING RESTRICTIVE COVENANT TO LIMIT USE IN COMMERCIAL AREAS? ~~Restore wetlands and implement restrictive covenant to maintain wetland areas~~

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- Implement restrictive covenant in capped areas to prohibit interference with the cap and fences and to prohibit groundwater use
- Restore wetlands and implement restrictive covenant to maintain wetland areas
- Monitor groundwater to verify effectiveness of remedy
- Implementation time: 2 years
- Net present value cost of $62,000,000

Note regarding Alternatives 2A, 2B, and 2C: Groundwater monitoring is included in all of the alternatives that leave waste in place and/or consolidated onsite. Monitoring would include upgradient and downgradient wells to determine if COCs are migrating offsite. Additionally, for each of the Alternative 2 options, the following two sub-alternatives were considered:

- Sub-alternative (i)—Groundwater collection and treatment, which includes a system of extraction wells or trenches installed downgradient to capture groundwater before discharge to Portage Creek.
- Sub-alternative (ii)—Slurry wall installed downgradient of groundwater flow along with extraction wells or trenches to prevent groundwater mounding behind the slurry wall.

Alternative 3—Total Removal and Off-site Disposal

- Excavate Outlying Areas and All Operational Areas to achieve appropriate PRGs
- Transport off site for disposal all materials above PRGs
- Backfill the excavation to above water table elevations in Operational Areas and to original grade in the Outlying Areas
- Implement restrictive covenant to limit use in commercial areas
- Implementation time: 5 years
- Net present value cost of $189,000,000.

Alternative 4—Encapsulation Containment System

- Excavate Outlying and All Operational Areas and stockpile the excavated materials
- Line bottom of OU1 with a 3-foot compacted clay liner (or geosynthetic equivalent) beneath two 40-mil flexible membrane liners. A leachate collection and monitoring system would be constructed between the FML layers
- Place excavated materials within the lined OU1 area
- Install cap on consolidated materials within the lined OU1 area
- Implement restrictive covenant to limit use in commercial areas
- Implement restrictive covenant in capped areas to prohibit interference with the cap and fences and to prohibit groundwater use
- Restore wetlands and implement restrictive covenant to maintain wetland areas
- Monitor groundwater to verify effectiveness of remedy
- Implementation time: 10 years
- Net present value cost of $136,000,000.

Common Elements of Alternatives

For all alternatives except Alternative 1 (No Further Action), predesign investigations are required to further delineate the nature and extent of PCBs exceeding the relevant PRGs in certain subareas of the site. As discussed below, each alternative includes excavation of soil and sediment above respective PRGs in Outlying Areas and in certain subareas of the Operational Area. Based on the RI, it is assumed that by addressing PCBs, other COCs also would be addressed. Confirmation sampling for PCBs and other COCs would be performed during the implementation of the remedial action to verify that respective PRGs have been achieved.

Certain Operational Subareas

Portions of the following subareas are contiguous and listed with the Operational Areas due to encroachment of waste material. However, the following subareas are discussed separately from the Bryant HRDL/FRDLs, Former Type III Landfill, and Western Disposal Area, due to the PRGs and proposed approach envisioned for Alternatives 2 through 4:

- **Former Raceway Channel**—During the predesign investigation, sediments in this area would be sampled for PCBs. Sediments exceeding the PRG of 0.33 mg/kg PCBs would be excavated. After confirmation samples indicate the 0.33 mg/kg PCB PRG and the appropriate Michigan Part 201 Non-Residential Criteria PRGs for other COCs have been achieved, the wetland would be restored and an environmental covenant would be implemented to maintain the wetlands.
- **Panelyte Property**—Waste materials are believed to have encroached onto the southern portion of the Panelyte Property from the Western Disposal Area. During the predesign investigation, this area would be sampled for PCBs. Soils exceeding the PRG of 10 mg/kg PCBs would be excavated. After confirmation samples indicate the 10 mg/kg PCB PRG and the appropriate Michigan Part 201 Non-Residential Criteria PRGs for other COCs have been achieved, the excavation would be backfilled with clean material. A restrictive covenant would be required to prohibit high occupancy use of this area.
- **Panelyte Marsh**—During the predesign investigation, sediments in this area would be sampled for PCBs. Sediments exceeding the PRG of 0.33 mg/kg PCBs would be excavated. After confirmation samples indicate the 0.33 mg/kg PCB PRG and the appropriate Michigan Part 201 Non-Residential Criteria PRGs for other COCs have been achieved, the wetland would be restored and an environmental covenant would be implemented to maintain the wetlands.
- **Conrail Property**—Waste materials are believed to have encroached onto the eastern portion of the Conrail Property from the Western Disposal Area. During the predesign investigation, the area would be sampled for PCBs. Soils exceeding the PRG of 10 mg/kg PCBs would be excavated. After confirmation samples indicate the 10 mg/kg PCB PRG and the appropriate Michigan Part 201 Non-Residential Criteria PRGs for other COCs have been achieved, the excavation would be backfilled with clean material. A restrictive covenant would be required to prohibit high occupancy use of this area.
- **State of Michigan Cork Street Property**—Waste materials are believed to have encroached onto the Cork Street Property from the Monarch HRDL. During the predesign investigation, the area would be sampled for PCBs. Soils exceeding the PRG of 10 mg/kg PCBs would be excavated. After confirmation samples indicate the 10 mg/kg PCB PRG and the appropriate Michigan Part 201 Non-Residential Criteria PRGs for other COCs have been achieved, the excavation would be backfilled with clean material. A restrictive covenant would be required to prohibit high occupancy use of this area.
- **Residential Properties (Outlying)**—During the predesign investigation, the subarea identified as "Residential Properties (Outlying)" would be sampled for PCBs. Soils exceeding the PRG of 1 mg/kg PCBs would be excavated. After confirmation samples indicate the 1 mg/kg PCB PRG and the appropriate Michigan Part 201 Residential Criteria PRGs for other COCs have been achieved, the excavation would be backfilled with clean material.
- **Clay Seam and East Bank Area (Outlying)**—Sampling of these areas has demonstrated that they meet a cleanup level below 1 mg/kg PCBs, and thus, no further action is anticipated in these areas.
- **Commercial Properties (Outlying)**—During the predesign investigation, the areas identified as Commercial Properties would be sampled for PCBs. This includes the Alcott Street Parking Lot, Former Filter Plant, Goodwill property, former Bryant Mill property, and Consumers Power property. Soils exceeding the PRG of 10 mg/kg PCBs would be excavated. After confirmation samples indicate the 10 mg/kg PCB PRG and the appropriate Michigan Part 201 Non-Residential Criteria PRGs for other COCs have been achieved, the excavation would be backfilled with clean material.

Subareas achieving PCB concentrations between 1 mg/kg and 10 mg/kg would require restrictive covenants preventing high occupancy use. Where there are buildings that serve to mitigate direct contact and hinder the ability to remove impacted materials, restrictive covenants would be employed that would require sampling and removal when existing structures are compromised. Parking lots would be investigated and excavated to meet PRGs, as necessary.

- **Former Bryant Mill Pond Area (Outlying)**— Soils in the Former Bryant Mill Pond, and sediment in the associated wetland area may have been impacted by the PCB contaminated seeps. During the predesign investigation, this area would be sampled for PCBs. Soils exceeding the PRG of 10 mg/kg PCBs, floodplain soils exceeding the PRG of 6.5 to 8.1 mg/kg PCBs, and sediments exceeding the PRG of 0.33 mg/kg PCBs would be excavated. After confirmation samples indicate the respective PRGs for PCBs and the appropriate Michigan Part 201 Non-Residential Criteria PRGs for other COCs have been achieved, the excavation would be backfilled with clean material. Wetlands were previously delineated in the Former Bryant Mill Pond Area and at least 1 acre of wetland would be mitigated for each acre filled. An environmental covenant would be implemented to maintain wetland areas.
- **Wetland Areas**—Known wetland areas have been discussed with the associated subareas. However, if additional wetland areas with suspected PCB impacts are identified within the Outlying or Operational Areas during the predesign investigation, the wetlands would be investigated for PCBs. Sediments exceeding the PRG of 0.33 mg/kg PCBs would be excavated. After confirmation samples indicate the 0.33 mg/kg PCB PRG and the appropriate Michigan Part 201 Non-Residential Criteria PRGs for other COCs were achieved, the wetland would be restored and an environmental covenant would be implemented to maintain the wetlands.
- **Floodplain Soils**—Known floodplain soils within the Outlying or Operational Areas have been discussed with the associated subareas. However, if additional floodplain soils with suspected PCB impacts are identified within the Outlying or Operational Areas during the predesign investigation, the area would be investigated for PCBs. Floodplain soils exceeding the PRG of 6.5 to 8.1 mg/kg PCBs would be excavated.
- **Sheet Pile Wall**—The 2,600 linear feet of sealed-joint sheet pile installed in 2001 along the western bank of Portage Creek was installed to stabilize the perimeter berms of the Bryant HRDL/FRDLs. Except for Alternative 1, partial or complete removal of the existing sheet pile wall has been evaluated as a component of each alternative.
- **Groundwater Monitoring**—Alternatives 2A, 2B, 2C, and 4 include a robust groundwater monitoring program to measure remedy performance, including monitoring wells located between the border of Allied Landfill and the City's drinking water well field. EPA would use this groundwater monitoring to determine whether the remedy effectively prevents the contaminated waste materials from impacting any groundwater leaving Allied Landfill. If the groundwater monitoring data indicates that the remedy is not effective and a groundwater plume has developed, EPA would develop and implement a separate groundwater remedy for Allied Landfill if appropriate. There is, however, no reason at this time to believe that a future groundwater remedy will be needed.

Description of Alternatives

Alternative 1—No Further Action

The NCP requires EPA to evaluate a No Further Action alternative when evaluating remedial options. The No Further Action alternative serves as a baseline against which the other potential remedial alternatives are compared. Under this alternative, no further active remediation would be performed in any portion of Allied Landfill. The potential for human and ecological receptors to be exposed to COCs would not be addressed, and there would remain a potential for COCs to erode into Portage Creek over

time since there would be no maintenance of the existing fence, cap, soil cover, or the other engineered control systems. Operation of the groundwater collection/treatment system would be discontinued.

Alternative 2—Consolidation and Capping

The primary element of Alternative 2 is the excavation of certain areas of the OU and in-place containment of the excavated materials on other portions of the OU. The Residential Properties (Outlying), the impacted portion of the Former Bryant Mill Pond, and Commercial Properties (Outlying) would be excavated as would portions of the Former Operational Areas. The excavated materials would be consolidated on the Bryant HRDL/FRDLs area, the Former Type III Landfill area, and Western Disposal Areas, and/or the Monarch HRDL area. The areas used for consolidation would be covered with an engineered composite landfill cap. The cap would be constructed with appropriate erosion controls and other measures to protect against flood events and other natural or human-induced incidents that might otherwise threaten the integrity of the disposal areas. As discussed below, three variations of Alternative 2 were developed to allow for variations in the material excavated and consolidation locations and methods.

Additionally, portions of the Bryant HRDL/FRDLs, Monarch HRDL, Former Type III Landfill, and Western Disposal Area perimeter would be excavated/pulled back and consolidated within the onsite disposal areas to create a setback (with concentrations less than 0.33 mg/kg PCBs) that would act as a protective buffer along the creek and to enhance long-term slope stability. All of the Alternative 2 options include long-term inspections and maintenance of the existing and newly installed engineered landfill caps and the remaining sheet pile. A long-term monitoring program would be implemented to verify the performance of the remedy, demonstrate that groundwater quality conforms to applicable criteria, and to provide for the appropriate management of landfill gas.

For the purpose of cost-estimating, it was assumed the cap would consist of six layers as shown in Figure 4Y. The layers are (from bottom to top): a non-woven geotextile, a 12-inch-thick (minimum) sand gas venting layer, a 30-millimeter polyvinyl chloride FML or equivalent (permeability less than 1×10^{-10} centimeters per second), a geosynthetic drainage composite layer, a 24-inch-thick (minimum) drainage and soil protection layer, and a 6-inch-thick (minimum) vegetated, topsoil layer. The proposed cap design contains the landfill cap components required under Michigan's Natural Resources and Environmental Protection Act (NREPA), as amended, Part 115.

The existing sheet pile wall would be evaluated during design to determine whether it can be removed completely or is required to stabilize the base of the landfill along Portage Creek. If the wall is required for stabilization, the wall would be cut off at ground surface and individual panels may be removed to allow groundwater flow to the creek, eliminating the need for the existing collection system.

The clean set back between the landfill and Portage Creek would allow room for monitoring wells and an optional groundwater collection and treatment system if deemed necessary based on the results of future sampling. The groundwater monitoring network consisting of existing and new monitoring wells would be located outside the areas where waste remains in place (Bryant HRDL/FRDLs and or/Monarch HRDL areas). The groundwater monitoring plan would also evaluate upgradient groundwater concentrations for determination of local background conditions. For the purposes of the cost estimates, it was assumed that 24 monitoring wells would be installed for monitoring in Alternative 2A, and 20 monitoring wells would be installed as part of Alternatives 2B and 2C.

All of the Alternative 2 options include sub-alternatives for hydraulic control of groundwater. For sub-alternative (i), a groundwater collection and treatment system would be installed. The groundwater

collection and treatment system would consist of groundwater extraction wells and a series of sumps and lateral drain lines. Sub-alternative (ii) would include the same groundwater collection and treatment system as sub-alternative (i), but in addition would include a grout slurry wall. The grout slurry wall would be installed downgradient of the Bryant HRDL/FRDLs and Monarch HRDL (if left in place) to contain impacted groundwater located within OU1. The slurry wall would extend approximately 40 feet below ground surface based on current sheet pile wall design. It is assumed that the slurry wall would not necessarily key into clay or bedrock; portions of the slurry wall at this depth would still terminate in the upper sand zones.

Alternative 2 includes restrictive covenants to prevent exposure of PCBs at depth and prohibit interference with the cap. Alternative 2 also includes informational devices, and access restrictions consisting of a perimeter fence with posted warning signs.

Alternative 2A—Consolidation of Outlying Areas on Bryant HRDL/FRDLs and Monarch HRDL

Under Alternative 2A, the excavated material from the Outlying Areas and certain perimeter areas of the Operational Areas would be consolidated on the Bryant HRDL/FRDLs and Monarch HRDL. These areas targeted for excavation and consolidation are shown in Figure X. After consolidation, each landfill would be covered with an engineered composite landfill cap.

Alternative 2B—Consolidation of Outlying Areas and the Monarch HRDL on Bryant HRDL/FRDLs

Under Alternative 2B, the excavated material from the Outlying Areas and certain perimeter areas of the Operational Areas would be consolidated on the Bryant HRDL/FRDLs landfill. The Monarch HRDL would also be excavated and consolidated on the Bryant HRDL/FRDLs landfill. The areas targeted for excavation and consolidation are shown in Figure 11. After consolidation, the Bryant HRDL/FRDLs landfill would be covered with an engineered composite landfill cap.

Alternative 2C—Consolidation of Outlying Areas and the Monarch HRDL on Bryant HRDL/FRDLs, with Off-site Incineration of Excavated Materials with PCB Concentrations Greater than 500 mg/kg

The extent of excavation and the consolidation areas are the same for Alternative 2C as described under Alternative 2B and are shown in Figure 11. Excavated materials with PCB concentrations greater than 500 mg/kg would be transported off site for incineration. Remaining materials with PCB concentrations of 500 mg/kg or less would be consolidated on the Bryant HRDL/FRDLs and subsequently covered with an engineered composite landfill cap.

A pre-design investigation would be used to identify materials exceeding 500 mg/kg PCBs within the areas to be excavated. For cost-estimating purposes, the feasibility study assumed that approximately 5 percent of the soils excavated from the pullback area near the Western Disposal Area and Former Type III Landfill would require off-site incineration, and that approximately 2 percent of soils excavated from the Outlying Areas, Monarch HRDL, and the setback between Portage Creek and Bryant HRDL/FRDLs would require offsite incineration. These assumptions were based on a statistical evaluation of the existing data sets.

Alternative 2D—Consolidation of Outlying Areas, the Monarch HRDL and portions of the former operation areas onto a reduced footprint of the Bryant HRDL/FRDLs

Under Alternative 2D the excavated material from the Outlying Areas and certain portions of the Operational Areas would be consolidated on to a reduced footprint of the Bryant HRDL/FRDLs landfill. The Monarch HRDL would also be excavated and consolidated on to the reduced footprint of the Bryant HRDL/FRDLs landfill. The areas targeted for excavation and consolidation are shown in Figure 12. The footprint waste area would be reduced from approximately 49 acres to approximately 27 acres. After consolidation, the Bryant HRDL/FRDLs landfill would be covered with an engineered composite landfill cap and an active landfill gas collection system would be installed. Excavated and backfilled areas, not a part of the flood zone, would be available for commercial/industrial redevelopment. The capped area would be available for light recreational reuse.

Alternative 3—Total Removal and Offsite Disposal

The primary element of Alternative 3 is the excavation and off-site disposal of all contaminated areas of OU1. The excavation areas would include the following:

- All Outlying Areas other than the portion of the Goodwill property that may be covered by buildings
- Former Operational Areas—The Monarch HRDL, the Former Type III Landfill, the Western Disposal Area, and the Bryant HRDL/FRDLs, along with portions of contiguous properties where waste materials are suspected to have encroached from the Western Disposal Area, including portions of Panelyte Marsh, Panelyte Property, the Conrail Railroad Property and the State of Michigan's Cork Street Property.

Materials would be excavated and transported directly to off-site commercial landfills. Materials with PCB concentrations of 50 mg/kg or greater would be transported to and disposed of in approved off-site landfills permitted to receive TSCA-regulated wastes. Materials with PCB concentrations less than 50 mg/kg would be transported to and disposed of at other permitted and approved landfills as appropriate. Excluded from removal are the PCB-containing materials that may be located under existing buildings on the Goodwill property.

Post-removal confirmatory sampling and analysis would be performed at the excavation areas. Once cleanup goals have been achieved, the excavated areas would be backfilled with clean material, graded to mitigate ponding, and revegetated or otherwise restored to match the surrounding areas. The Panelyte Marsh, the Former Monarch Raceway Channel, and other wetland areas would be backfilled to existing grades and restored to promote the re-establishment of wetland vegetation. The excavated and backfilled area would extend across approximately 65 acres. Restrictive covenants to maintain wetlands areas would be required.

In addition, part of this alternative would include the removal of 2,600 linear feet of sealed-joint sheet pile along the western bank of Portage Creek to the extent feasible. The existing groundwater treatment system would be decommissioned and removed, and the network of groundwater extraction trenches, sumps, and wells currently in place behind the sheet pile wall would be removed and disposed.

This alternative was developed with the intent of removing all material containing COCs above OU1 PRGs. However, if it is not feasible to remove some of the material, groundwater monitoring would be performed in areas where materials remain above cleanup levels. Monitoring would be performed as described in Alternatives 2 and 4. Institutional controls (for example, restrictive covenants and enforcement tools) would be implemented for the areas where COCs may be left in place.

Alternative 4—Encapsulation Containment System

The primary element of Alternative 4 is the full encapsulation of impacted materials on site, including the following:

- Excavate approximately 1,600,000 yd^3 of soil and/or sediment containing PCBs above the relevant PRGs
- Construct a landfill bottom liner in excavated former landfill areas. The base of the liner would likely consist of a 3-foot compacted clay liner (or geosynthetic equivalent) beneath two 40-mil FMLs. A leachate collection and monitoring system would be constructed between the FML layers.
- Place excavated materials on the newly-constructed landfill liner
- Consolidate the excavated PCB-containing materials in the newly-lined landfill areas
- Construct an engineered composite landfill cap over the new landfill areas (same type of landfill cap as Alternative 2)
- Depending on the capacity of the new landfill areas, some materials may need to be disposed of at off-site commercial landfills

In the Outlying Areas, once cleanup goals have been achieved, the excavated areas would be backfilled with clean material, graded to mitigate ponding, and revegetated or otherwise restored to match the surrounding area. The Panelyte Marsh and Former Monarch Raceway Channel would be backfilled to existing grades and restored to promote the re-establishment of wetland vegetation. All excavated materials would be sequentially stockpiled on site during construction of a series of landfill containment cells, constructed on site in the locations of the current Former Operational Areas.

Work in the Former Operational Areas could potentially be carried out in the following manner:

- Excavate soils from the Monarch HRDL and temporarily stage the soils in the Western Disposal Area. Backfill the Monarch HRDL with approximately 10 feet of imported clean fill to establish the base liner 4 feet above the water table for the disposal cell. Construct the base liner, transport approximately 75 percent of the excavated Monarch HRDL soils back to the Monarch cell, place/grade/compact the soils, and construct the final cap. The remaining 25 percent of soils volumetrically displaced would be transported offsite for disposal.
- Repeat the above process for the Bryant HRDL/FRDLs, then the Former Type III Landfill.
- Repeat the above process for the western half of the Western Disposal Area, but without constructing the final cover system.
- Complete the process for the eastern half of the Western Disposal Area, and then construct the final cover system over the entire Western Disposal Area.

The containment system disposal cells would be designed and built to include a double composite base liner system constructed a minimum distance of 10 feet above the groundwater table and graded to a minimum slope of 2 percent to promote drainage. For the purposes of cost estimating, it was assumed the base liner system would consist of the following components, from top down: a 40-mil primary FML, underlain by a geosynthetic clay liner (GCL), a leachate collection system consisting of a geosynthetic drainage composite (GDC) layer draining to a pumpable sump system, a leak detection system, a secondary 40-mil FML, and a secondary 3-foot compacted clay liner (or geosynthetic equivalent). The GCL would have a maximum hydraulic conductivity of 1×10^{-7} cm/s, and the GDC would have a minimum transmissivity of 3×10^{-4} square meters per second.

The removed materials would be placed within the disposal cells with a cover liner system (i.e., cap) sloped to grades of no less than 4 percent and consisting of the following components, from top down: a 6-inch vegetative soil layer, a 24-inch protective soil layer, a GDC, a 40-mil FML, a GCL, a non-woven needle-punched geotextile, a minimum 12-inch gas-venting layer with gas vents at appropriately spaced intervals, a basal non-woven needle-punched geotextile, and a soil grading layer. The cap would be constructed with appropriate erosion controls and other measures to protect against flood events and other natural or human-induced incidents that might otherwise threaten the integrity of the disposal areas. The final cover system would cover approximately 50 acres.

Excess excavated materials that do not fit in the landfill containment cells (because the height of the cells is limited due to the need to attain the desired side-slope grade) would be transported to and disposed of in appropriately permitted off-site landfills. Approximately 25 percent of the soils targeted for excavation and re-emplacement in the Former Operational Areas and all of the soils excavated from the various Outlying Areas would be volumetrically displaced, which means that more than 500,000 yd^3 of materials would have to be transported off-site for disposal. Such materials with PCB concentrations of 50 mg/kg or greater would be transported to and disposed of in approved off-site landfills permitted to receive TSCA-regulated wastes. Materials with PCB concentrations less than 50 mg/kg would be transported to and disposed of at other permitted and approved landfills as appropriate. Excluded from removal are the PCB-containing materials that may be located under existing buildings on the Goodwill property. Excavated areas would be backfilled with clean material, graded, and revegetated or otherwise restored to match the surrounding areas. The excavated and backfilled area would extend across approximately 65 acres.

Part of this alternative would include removal of 2,600 linear feet of sealed-joint sheet pile along the western bank of Portage Creek. The need to leave portions of the sheet pile wall in place for landfill slope and bank stability would be further evaluated in the design. The potential for groundwater mounding behind the wall would be considered as part of the evaluation. The existing groundwater treatment system would be decommissioned and removed, and the network of groundwater extraction trenches, sumps, and wells currently in place behind the sheet pile wall would be removed and disposed.

Under Alternative 4, EPA would establish the same type of groundwater monitoring system as described for Alternative 2.

EVALUATION OF ALTERNATIVES

The NCP requires EPA to use nine criteria to evaluate the different remediation alternatives individually and against each other in order to select a remedy. This section of the Proposed Plan evaluates each alternative against the nine criteria and notes how each compares to the other options under consideration. More details regarding this evaluation can be found in the FS Report.

The nine criteria are divided into three groups: threshold, balancing, and modifying criteria. Alternatives that do not meet the threshold criteria are not considered further.

Threshold Criteria

1. Overall Protection of Human Health and the Environment

This criterion assesses how well the alternatives achieve and maintain protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled, through treatment, engineering controls, and/or institutional controls.

Alternative 1 would provide no improved protection over the current conditions, would provide no risk reduction, would not be protective of human health or the environment, and would not achieve RAOs.

Alternatives 2, 3, and 4 would all be protective of human health and the environment and would be effective long-term remedies for Allied Landfill as long as all elements of the remedy, including O&M and monitoring, are properly maintained. These alternatives would also achieve all three RAOs that have been established for the remedial action.

The primary exposure pathways at Allied Landfill are associated with the following:

- Consumption of PCB-contaminated fish
- Direct contact with exposed materials with COCs above PRGs
- Inhalation of dust and volatile emissions from floodplain soils and consolidated residuals
- Ingestion of or direct contact with groundwater impacted above PRGs

Transport mechanisms that may result in completed exposure pathways include the following:

- Transport of groundwater impacted by contaminated material
- Surface water runoff
- Wind dispersion of exposed materials with COCs above PRGs
- Erosion of contaminated materials to Portage Creek and the Kalamazoo River

Alternatives 2, 3, and 4 each achieve protectiveness through excavation of exposed contaminated soils with consolidation onsite beneath a landfill cap and/or offsite disposal to prevent direct contact and transportation by erosion. Alternative 2C includes an offsite incineration component for the most contaminated excavated soils. Alternative 3 includes complete removal and offsite disposal to eliminate the potential for exposure.

Under current conditions, PCBs are not migrating outside the waste via groundwater. Alternatives 2 and 4 each further mitigate the potential for groundwater transport through capping, which would prevent infiltration of surface water through the consolidated soils. Alternative 4 includes the installation of a bottom liner beneath the waste materials. However, gHowiven the site conditions (impermeability of the waste and upward flow of groundwater), Alternative 4 may not be significantly more protective than Alternative 2.

The groundwater and seep samples collected during the RI that had elevated PCB concentrations were generally located in areas of Allied Landfill that were not addressed by IRM activities, and these areas would all be addressed by Alternatives 2, 3, and 4. Alternative 3 includes complete removal and offsite disposal to eliminate the potential for leaching and colloidal transport.

As noted earlier, EPA has analyzed groundwater data collected at and around Allied Landfill and has concluded that PCBs at concentrations that pose a risk are not migrating off-site via groundwater or surface water. For this reason, EPA believes that groundwater sub-alternatives (i) and (ii) are not

necessary for the Alternative 2 options to be protective, because the addition of groundwater collection systems under sub-alternatives (i) and (ii) would not significantly increase overall protectiveness.

2. Compliance with Applicable or Relevant and Appropriate Requirements

This criterion assesses how the alternatives comply with regulatory requirements. Federal and state regulatory requirements that are either applicable or relevant and appropriate are known as ARARs. Only state requirements that are more stringent than federal requirements are ARARs. There are three different types of regulatory requirements: chemical-specific ARARs, action-specific ARARs, and location-specific ARARs.

Alternative 1 would not meet ARARs because taking no action would pose an unreasonable risk of injury to health or the environment. Alternative 1 would therefore not meet 40 C.F.R. §761.61(c) and would not prevent stormwater or venting groundwater discharges to Portage Creek, in violation of Parts 31 and 201 of Michigan's Natural Resources and Environmental Protection Act (NREPA).

Alternatives 2, 3, and 4 would all meet ARARs, as discussed below.

Alternatives 2 and 4 would rely on a risk-based method to address PCBs under TSCA and 40 C.F.R. §761.61(c). Alternatives 2 and 4 would not pose an unreasonable risk of injury to health or the environment pursuant to 40 C.F.R. §761.61(c) for the following reasons: a) they would meet the PCB PRGs set forth in Table 1 for surface soils, subsurface soils, sediment, and groundwater; b) a cap would be constructed over the landfill areas to eliminate direct contact hazards and minimize infiltration[1] of precipitation through the landfill and subsequent migration of residuals or leachate from the landfill into the adjacent areas; c) they include restrictive covenants for caps, fences and low occupancy areas required by 40 C.F.R. §761.61(b)(8); and d) they would achieve the RAOs.

Alternative 3 would also meet TSCA and 40 C.F.R. §761.61.

Alternatives 2, 3, and 4 comply with wetlands ARARs because compensatory wetland mitigation would be provided in accordance with the Federal Mitigation Rule set forth at 40 C.F.R. §230.94(c)(2-14) for any wetlands that are or have been filled during remediation.

Under Alternatives 2 and 4, groundwater monitoring would be conducted to confirm that site COCs meet Michigan Part 201 GSI criteria in groundwater venting from the shallow aquifer into Portage Creek. Further, Alternatives 2 and 4 include groundwater monitoring in both the shallow and lower aquifer to confirm that site COCs are not impacting the lower aquifer. Safe Drinking Water Act MCLs are not considered ARARs at this time because EPA believes that site COCs are not migrating off-site and do not reach the lower aquifer. Groundwater samples would be collected and analyzed from the shallow and lower aquifer under Alternatives 2 and 4 in accordance with NREPA Part 201 and 40 C.F.R. §761.75(b).

Balancing Criteria

3. Long-term Effectiveness and Permanence

[1] The landfill cap for Alternative 2 and Alternative 4 includes a polyvinyl chloride FML or equivalent with a permeability less than 1 x 10^{-10} cm/s.

This criterion evaluates the effectiveness of the alternatives in protecting human health and the environment over the long term, once the cleanup is complete, including the adequacy and reliability of controls.

With the exception of Alternative 1, each of the alternatives would be expected to meet all three RAOs and provide long-term effectiveness and permanence once the RAOs are met. The active alternatives are combinations of proven and reliable remedial processes, and the potential for failure of any individual component is low.

Alternatives 2 and 4 would achieve long-term effectiveness and permanence through on-site containment of the contaminated materials as a primary component of the remedy, with O&M, monitoring, and institutional controls to collectively ensure and verify the permanence of the remedy. Capping is a proven method of preventing direct contact and erosion of material containing PCBs. Alternative 2C, which includes off-site incineration of excavated materials with PCB concentrations greater than 500 mg/kg, would not significantly increase the long-term effectiveness of the remedy, because capping prevents direct contact exposure and the erosion/transport exposure route.

Capping is an effective mechanism to prevent infiltration through materials containing PCBs. At Allied Landfill, PCBs have not been detected in groundwater outside the waste, even though some of the landfill areas are not currently capped. The installation of an engineered composite cover system would serve to further mitigate the potential for infiltration and migration of PCBs out of the waste via groundwater. Groundwater sub-alternatives (i) or (ii) do not significantly increase the long-term effectiveness or permanence of Alternative 2.

Alternative 3 would achieve long-term effectiveness and permanence by removing all contaminated materials with COC exceedances from Allied Landfill and disposing of those materials at off-site solid waste landfills and TSCA facilities.

Alternative 4 would achieve long-term effectiveness and permanence by placing the contaminated materials into containment cells constructed onsite, with O&M, monitoring, and institutional controls in place to ensure protectiveness over time.

Under Alternative 3, materials with COC concentrations above relevant cleanup levels would be excavated and disposed of offsite. No long-term O&M or monitoring would be required under this alternative, with the possible exception of certain limited areas where waste may be left in place because of the proximity to buildings. The large-scale removal and off-site disposal of materials under this alternative provides an added degree of permanence through removal of the materials from Allied Landfill.

The Alternative 2 options include proven technologies that would provide long-term effectiveness and permanence. Alternative 4 provides an added level of protectiveness because wastes are controlled in lined, on-site containment cells. Alternative 3 provides the greatest degree of long-term effectiveness and permanence by removing the materials from Allied Landfill. The main difference between Alternatives 3 and 4 is that the waste is moved and managed offsite in Alternative 3, versus being managed on-site in Alternative 4 in lined containment cells.

The long-term O&M and monitoring components that would be implemented in conjunction with institutional controls under Alternative 4 and the Alternative 2 options would provide the necessary mechanisms to verify that the remedy is performing as anticipated over time. As a result, Alternative 4 and the Alternative 2 options are also expected to provide effective, permanent remedies.

4. Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment

This criterion evaluates the anticipated performance of the treatment technologies that may be included as part of a remedy.

Alternatives 1, 2A, 2B, 3, and 4 do not include treatment as a component of the remedy and therefore would not reduce the toxicity, mobility, or volume of contamination at Allied Landfill. The only remedial alternative that includes treatment as a component of the remedy is Alternative 2C. Alternative 2C would treat a very small percentage of the waste at the site through off-site incineration of excavated soils that exceed 500 mg/kg, so would not significantly reduce the toxicity, mobility, or volume of contamination at Allied Landfill.

At the request of the EPA Region 5 Superfund Division management, representatives of the Office of Research and Development's Engineering Technical Support Center (ORD) and Office of Superfund Remediation and Technology Innovation (OSRTI), performed an evaluation of the status of technologies potentially applicable for the remediation of polychlorinated biphenyls (PCBs) at the subject site. Region 5 convened the meeting in response to the mayor's request for a meeting to discuss the current status of PCBs treatment research within the EPA, new and emerging PCBs treatment technologies used at sites, the EPA's approval process for implementing new emerging technologies at Superfund sites, and opportunities for the city to tour EPA facilities with research on PCBs treatment.

Commented [BM12]: To what degree do we discuss the mayor in this section?

OSRTI and ORD pointed out in the presentation that historically landfilling/consolidation or excavation with thermal treatment (incineration or thermal desorption) have been selected most often as a remedy at sites with PCBs-contaminated soils in the U.S. Other existing technologies discussed during the meeting included solidification/stabilization, in situ thermal treatment, bioremediation, phytoremediation, hydrogen reduction and solvent extraction/chemical dehalogenation.

Commented [BM13]: Do we want to include a table on treatment technologies?

OSRTI and ORD suggest that, due to the nature of the waste, there is not a cost-effective treatment technology to treat PCBs in place at this site that would meet presumed site-specific cleanup standards. There may be chemical, thermal or biological treatment technologies that could be applied to PCBs once the soils are excavated. However, the costs and project durations for these technologies would be substantially greater for this site than an onsite containment alternative without a substantially greater reduction in human health or ecological risk at the OU. The PCBs present at the OU have been there for decades, and are bound tightly to soil, clay and paper fibers through adsorption. This occurred as an unintended result of Allied Paper's recycling process and makes the PCBs less bioavailable and less mobile. Additionally, the clay serves to reduce the velocity of groundwater flow through the OU so significantly that the current groundwater flow nearly meets typical EPA design parameters for solidification/stabilization waste treatment.

OSRTI and ORD evaluated the applicability of in-situ Bioremediation and considered the potential for future research that may enable in situ application of bioremediation for PCBs in soil. Bioremediation continues to undergo research into its use on PCBs. Bioremediation development as well as implementation at a site like Allied Paper Landfill currently make it an impractical remedy. While the use of bioremediation technologies on PCBs continues to be researched, there does not appear to be a commercially available bioremediation approach at this time applicable to a site like Allied ~~Paper~~ Landfill. If one existed or is developed in the future, it would likely require multiple decades for full implementation based on treatment time durations found with bioremediation technologies used for contaminants at other sites.

5. Short-term Effectiveness

This criterion examines the length of time needed to implement the alternatives and the effectiveness of the alternatives in protecting human health and the environment during construction of the remedy. It considers any adverse impacts that may be posed to the community, workers, and the environment during the cleanup.

For Allied Landfill, the evaluation of short-term effectiveness is primarily related to the area and volume of COC-containing materials addressed in each alternative, the time necessary to implement the remedy, potential risks to workers, and potential impacts to the community during construction. Short-term effectiveness is summarized in Table 4.

With the exception of Alternative 1, all the alternatives with active remedial components would have some short-term impacts during construction, including increased noise from construction vehicles, the potential for airborne dust releases, increased traffic in the vicinity of Allied Landfill, increased wear on local roads, increased potential for workers to come in contact with PCB-containing materials, and other risks associated with construction work. Potential adverse impacts can be minimized through implementing a project-specific health and safety plan, keeping excavation areas properly wetted, planning truck routes to minimize disturbances to the surrounding community, and other standard best management practices, but the impacts cannot be eliminated.

For the alternatives with active remediation, the Alternative 2 options require the least amount of materials to be disturbed and the shortest construction time (2 years). An estimated 39,000 truck trips would be required to implement Alternative 2A, and more than 49,000 truck trips would be required to implement Alternative 2B. Alternative 2C incurs additional short-term impacts associated with offsite transport. It is estimated that an additional 1,000 truck trips would be required to haul the most highly-contaminated materials approximately 40 miles to an intermodal facility where they would be loaded onto railcars for transport to the incineration facility. Due to the limited number and location of TSCA-permitted incineration facilities, the rail transport distance for the contaminated materials could be 1,200 miles or more. Alternative 2C also has greater short-term impacts than Alternatives 2A and 2B due to the potential for dispersion or erosion of excavated materials during characterization and segregation for incineration. The addition of sub-alternatives (i) or (ii) increase the short-term impacts of the Alternative 2 options, with sub-alternative (ii) having greater short-term impacts than sub-alternative (i).

Alternatives 3 and 4 present greater short-term impacts than the Alternative 2 options because of the increased volume of materials that would be disturbed and moved as well as the increased construction duration (5 years and 10 years, respectively). Because the project duration for Alternatives 3 and 4 is longer than the Alternative 2 options, they pose greater construction-related and exposure risks to workers. The additional volume of materials to be handled in Alternatives 3 and 4 also results in an increase in truck traffic in the vicinity of Allied Landfill during the project. An estimated 150,000 truck trips to and from OU1 would be necessary to implement Alternative 3. During the excavation and backfilling work under Alternative 4, more than 116,000 truck trips would be necessary to transport excavated material from the Outlying Areas to the on-site disposal cells, to bring in clean fill, and to haul displaced materials to off-site disposal locations. Any increase in truck traffic carries with it an increased risk of vehicular accidents.

Besides the impacts discussed above, there are additional adverse impacts to the local community during construction, such as the potential for noise and dust. Such impacts could occur over a period of 2 years (Alternatives 2A, 2B, or 2C), 5 years (Alternative 3), or 10 years (Alternative 4), which would place

an increased burden on the local community over time. Although traffic impacts associated with Alternative 4 are primarily limited to 5 years, the overall construction duration (with the potential for noise and dust) is estimated at 10 years due to the onsite management and emplacement of excavated materials.

There are no short-term impacts associated with construction or implementation for Alternative 1; however, since existing measures in place to control access to Allied Landfill would not be maintained, there could be an increased risk of direct exposure over the short term to individuals who trespass and come into contact with surficial contaminated materials.

6. Implementability

This criterion assesses the technical and administrative feasibility of an alternative and the availability of required goods and services. *Technical feasibility* considers the ability to construct and operate a technology and its reliability, the ease of undertaking additional remedial actions, and the ability to monitor the effectiveness of a remedy. *Administrative feasibility* considers the ability to obtain approvals from other parties or agencies and the extent of required coordination with other parties or agencies.

There are no technical or administrative implementability issues associated with Alternative 1 because no active remediation would take place. The primary remedial components of the Alternative 2 options, Alternative 3, and Alternative 4 are proven, readily implementable, have been used successfully as part of other environmental cleanup projects, and are expected to be reliable over the long term. All the alternatives are administratively implementable, and although no permits would be required, the substantive applicable requirements of federal and state regulations would need to be identified and would be met.

The Alternative 2 options, Alternative 3, and Alternative 4 could all be completed using readily available conventional earth-moving equipment, and most of the necessary services and construction materials are expected to be readily available. Qualified commercial contractors with experience at other areas of the Kalamazoo River Superfund site are available locally to perform the work.

Compared to Alternatives 2A and 2B, Alternatives 2C, 3 and 4 would be more difficult to implement due to different constraining conditions. For Alternative 2C, there is limited availability of TSCA permitted incinerators. For Alternative 3, the availability of solid waste and/or TSCA landfills to accept the volume of materials to be disposed of offsite could be a limiting factor in terms of construction progress and overall cost. The limited staging area available for excavated materials during construction of the containment cells would be a limiting factor for Alternative 4.

Commented [RLF14]: Need to make sure this language agrees with what Rick wanted the FS to say about Alternative 3.

Landfill Availability

There are few solid waste landfills in southwest Michigan that are available to accept PCB-containing material, regardless of whether that material meets solid waste regulatory requirements. The facilities commonly have limits on disposal capacity and disposal rates that may affect the timely completion of Alternatives 3 and 4 in which a large volume of PCB- and other COC-containing material would be disposed of offsite. If capacity at local solid waste facilities and TSCA landfills is exhausted, use of facilities outside of southwest Michigan could increase transport distances for off-site disposal, and consequentially increase risks and costs.

Construction of the Containment Cells

Additional implementability challenges associated with the construction of the containment cells in Alternative 4 include sequencing and space constraints, developing a plan for excavating nearly 1,600,000 yd^3 of COC-containing materials, constructing the full-encapsulation disposal cells, and replacing the excavated materials in the cells. As each containment cell is sequentially constructed, a successively smaller area would be available onsite for staging of clean materials and temporary storage of COC-containing materials. Eventually, on-site capacity would be depleted, and a substantial volume of material would have to be disposed of offsite. Approximately 25 percent of the soils targeted for excavation and placement in the Former Operational Areas and all of the soils excavated from the Outlying Areas would be volumetrically displaced, resulting in more than 500,000 yd^3 of materials being transported offsite for disposal. This has a significant impact on both the implementability and cost of this alternative. The control and management of surface water runoff from the temporarily-stored COC-containing materials also would become increasingly challenging as less area was available for the operations under Alternative 4.

6. Cost

This criterion evaluates the capital and operation and maintenance costs of each alternative. Present-worth costs are presented to help compare costs among alternatives with different implementation times.

The costs for the range of alternatives and sub-alternatives presented in this Proposed Plan are summarized in the table below. The cost estimates are consistent with an FS-level of estimation, with an accuracy of +50 to -30 percent. While Alternative 1 has no associated capital or O&M costs since there would be no further actions taken, five-year reviews would be required and those periodic costs are reflected in the table below.

Summary of Remedial Alternative Costs
Allied Landfill—Allied Paper, Inc. / Portage Creek / Kalamazoo River Superfund site

Alternative	Estimated Capital Cost	Estimated O&M Cost	Estimated Periodic Cost	Total Present-worth Cost
Alternative 1	$0	$0	$120,000	$120,0000
Alternative 2A	$36 million	$7.4 million	$120,000	$43 million
Subalternative (i)	$1.6 million	$3.1 million	$0	$4.6 million
Subalternative (ii)	$10 million	$3.1 million	$0	$13.0 million
Alternative 2B	$36 million	$5.5 million	$120,000	$41 million
Subalternative (i)	$1.5 million	$3.1 million	$0	$4.5 million
Subalternative (ii)	$8.6 million	$3.1 million	$0	$11.7 million
Alternative 2C	$57 million	$5.5 million	$120,000	$62.0 million
Subalternative (i)	$1.5 million	$3.1 million	$0	$4.5 million
Subalternative (ii)	$8.6 million	$3.1 million	$0	$11.7 million
Alternative 3	$188 million	$0 million	$120,000	$189 million
Alternative 4	$131 million	$5.5 million	$120,000	$136 million

Note: The costs for the sub-alternatives under the Alternative 2 options would be in addition to the cost of each respective option.

A summary of the comparative analysis of alternatives with respect to the threshold and balancing criteria is presented in Table 5.

Modifying Criteria

7. State/Support Agency Acceptance

This criterion considers the state's preferences among or concerns about the alternatives, including comments on regulatory criteria or proposed use of waivers.

The State of Michigan supports EPA's preferred alternative, Alternative 2B.

8. Community Acceptance

This criterion considers the community's preferences or concerns about the alternatives. Community acceptance of the preferred alternative will be fully evaluated after the public comment period ends and will be described in the Record of Decision.

SUMMARY OF THE PREFERRED ALTERNATIVE

EPA's preferred alternative for addressing the contamination at Allied Landfill is Alternative 2B – **Consolidation of Outlying Areas and Monarch HRDL on the Bryant HRDL/FRDLs, Former Type III Landfill, and Western Disposal Area**. Alternative 2B meets the threshold criteria, offers a high degree of long-term effectiveness and permanence, and represents the best balance of tradeoffs among the other alternatives with respect to the balancing criteria by achieving the best balance of long-term and short-term effectiveness, implementability, and cost. Alternative 2B would meet the RAOs because it would:

- prevent human and ecological exposure to contaminated materials at OU1;
- prevent erosion and off-site migration of contaminated materials from OU1, the most significant route of exposure; and
- prevent contaminated material at OU1 from impacting groundwater or surface water emanating from OU1.

EPA believes that Alternative 2B is the appropriate remedy for OU1 given the immobility of the contamination as evidenced by both soil and groundwater data. The fact that the contamination is not migrating to groundwater at levels that pose a risk to human health or the environment demonstrates that the waste can be reliably contained in place. Alternative 2B would achieve the RAOs within a reasonable timeframe of two years, a shorter time period than total removal or encapsulation. Its shorter duration also would result in less short-term adverse impacts to the local community than the alternatives that take longer to implement, and would not incur the higher risks associated with exposing and handling all of the waste that would be associated with Alternatives 3 or 4.

While Alternatives 2A, 2B, 2C, 3, and 4 would all be protective and comply with regulatory requirements, Alternative 2B would do this at a lower cost than the other alternatives. Among the waste-in-place alternatives, Alternative 2B leaves the smallest landfill footprint and therefore requires the least amount of effort to maintain protectiveness over the long term.

Commented [RLF15]: I don't think we want to imply that ALL of the alternatives are cost effective. In fact, I think Joan would say that Alternatives 2C, 3 and 4 are NOT cost effective. I deleted a bunch of this language b/c I don't think we need to go into too much detail in the proposed plan about cost effectiveness. We'll need to have those discussions in the ROD, but not here.

Based on the information available at this time, EPA and the State of Michigan believe that the preferred alternative will be protective of human health and the environment, comply with ARARs, be cost-effective, and utilize permanent solutions and alternative treatment technologies to the maximum extent practicable. The preferred alternative does not include a treatment component, so does not satisfy the statutory preference for treatment as a principal element. EPA does not consider the wastes at Allied

Landfill to be principal threat wastes because they do not appear to act as a source material and can be reliably contained in place due to their immobility. The preferred alternative may change in response to public comment or new information.

COMMUNITY PARTICIPATION

EPA and MDEQ provide information regarding the cleanup of Allied Landfill to the public through public meetings, the Administrative Record file for the site, the site Information Repository at the Kalamazoo Public Library, and announcements published in the XXX. EPA and MDEQ encourage the public to gain a comprehensive understanding of the site by reviewing this proposed plan and the information available at the public repository.

The dates for the public comment period, the date, location, and time of the public meeting and the locations of the Administrative Record files are provided on the front page of this Proposed Plan.

TABLE 1

Commented [JC16]: Add Notes from current new FS

Summary of Preliminary Remediation Goals Established by EPA for PCBs

OU1 Feasibility Study Report—Allied Paper, Inc./ Portage Creek/Kalamazoo River Superfund site

Medium	Pathway		PCB PRG	Basis
Soils	Human Health	Residential	1.0 mg/kg[a]	40 CFR § 761.61(a)(4)
		Non-Residential	10 mg/kg[b]	40 CFR § 761.61(a)(4)
		Recreational	23 mg/kg[c]	HHRA
	Ecological	Aquatic	0.5–0.6 mg/kg	BERA
		Terrestrial	6.5–8.1 mg/kg	BERA
Subsurface Soils	Human Health	Residential	1.0 mg/kg[a]	40 CFR § 761.61(a)(4)
		Non-Residential	10 mg/kg[b]	40 CFR § 761.61(a)(4)
Surface and Subsurface Sediments	Human Health	Recreational	23 mg/kg[c]	HHRA
		Terrestrial	6.5–8.1 mg/kg	BERA
		Fish Consumption	0.33 mg/kg[c,d]	HHRA
	Ecological	Aquatic	0.5–0.6 mg/kg	BERA
Groundwater (including seeps)	Human Health	Direct Contact	3.3 µg/L[e]	MI Part 201 direct contact criteria
		Groundwater-Surface Water Interface (GSI)	0.2 µg/L[f]	MI Part 201 GSI criteria
Residuals	N/A	Qualitative: Where a removal is proposed, all visible residuals are to be removed unless analytical data are available to confirm PCBs (if present) are below applicable criteria.		

Notes:

[a] Based on high-occupancy cleanup level (without conditions) set forth in 40 CFR § 761.61(a)(4).

[b] Based on 40 CFR § 761.61(a)(4) with restrictive covenant prohibiting high occupancy use.

[c] Based on recreational exposure as developed in HHRA.

[d] Default sediment criteria of 0.33 mg/kg will be applied to shallow soil in areas of periodic inundation due to the potential runoff of shallow soils into surface water. Evaluation of contaminated soil runoff to surface water required under R299.5728(f).

[e] Groundwater for use as drinking water is not considered a complete pathway so the Part 201 Drinking Water criteria of 0.5 microgram per liter (μ g/L) was not used. The Part 201 direct contact criteria were used for protection of human health due to the presence of seeps.

[f] The groundwater criteria protective of surface water is a PRG where the GSI is present (MCL 324.20120e and Part 31).

BERA = baseline ecological risk assessment; HHRA = human health risk assessment; mg/kg = milligrams per kilogram;

N/A = not applicable

Source: CH2M HILL 2009

TABLE 2

Summary of ~~Proposed Remediation Action Levels~~Preliminary Remediation Goals for COCs other than PCBs

Allied Landfill—Allied Paper, Inc. / Portage Creek / Kalamazoo River Superfund site

	Soils/Sediments (µg/kg)					Groundwater and Seeps [a] (µg/L)	
Analyte	Statewide Default Background Level	Residential Drinking Water Protection Criteria & RBSLs	Groundwater Surface Water Interface Protection Criteria and RBSLs	Residential Direct Contact Criteria & RBSLs	Non-Residential Direct Contact Criteria & RBSLs	Residential Drinking Water Criteria & RBSLs	Groundwater Surface Water Interface Criteria & RBSL
SVOCs							
4-methylphenol	N/A	7,400	1,000	11,000,000	36,000,000	370	30
PCDD/PCDF [b]							
Total TCDD Equivalent(O)	N/A	NLL	NLL	0.09	0.99	N/A	
Inorganics							
Aluminum (B)	6,900,000	1,000	N/A	50,000,000	370,000,000	50	N/A
Antimony	N/A	4,300	94,000	180,000	670,000	6	130
Arsenic	5,800	4,600	4,600	7,600	37,000	10	10
Barium (B)	75,000 [c]	1,300,000	660,000 (G)	37,000,000	130,000,000	2,000	1,000 (G)
Cadmium (B)	1,200 [c]	6,000	3,000 (G)	550,000	2,100,000	5	2.5 (G)
Chromium	N/A	30,000	3,300	2,500,000	9,200,000	100	11
Cobalt	6,800	800	2,000	2,600,000	9,000,000	40	100
Copper	32,000 [c]	5,800,000	100,000 (G)	20,000,000	73,000,000	1,000	18 (G)
Cyanide	390	4,000	100	12,000	250,000	200	5.2
Iron (B)	12,000,000	6,000	N/A	160,000,000	580,000,000	300 (E)	N/A
Lead (B)	21,000 [c]	700,000	2,500,000 (G)	400,000	900,000	4	14 (G)
Magnesium (B)	N/A	8,000,000	N/A	1,000,000,000	1,000,000,000	400,000	N/A
Manganese (B)	440,000	1,000	26,000 (G)	25,000,000	90,000,000	50	1,300 (G)
Mercury	130	1,700	50	160,000	580,000	2	0.0013
Nickel	20,000 [c]	100,000	100,000 (G)	40,000,000	150,000,000	100	100 (G)
Selenium	410	4,000	400	2,600,000	9,600,000	50	5
Zinc	47,000 [c]	2,400,000	230,000 (G)	170,000,000	630,000,000	2,400	235 (G)

[a] Only the data from the 2002–2003 groundwater and seep samples are summarized to reflect conditions after removal.

[b] Dioxin and furans were only sampled in 1998.

[c] Background value used in RI as screening criteria, lowest risk-based level highlighted used for COC comparison.

N/A = Not Applicable, NLL= Not likely to leach, RBSL = risk-based screening level, µg/kg = micrograms per kilogram

(B) Background, as defined in R 299.5701(b), may be substituted if higher than the calculated cleanup criterion.

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(E) Criterion is the aesthetic drinking water value, as required by Section 20120a(5) of the Natural Resources and Environmental Protection Act 1994 PA 451, as amended by the Natural Resources and Environmental Protection Act of 1994
(G) Calculated value dependent on ph, hardness
(O) The concentration of all polychlorinated and polybrominated dibenzodioxin and dibenzofuran isomers present at a facility, expressed as an equivalent concentration of 2,3,7,8-tetrachlorodibenzo-p-dioxin based upon their relative potency, shall be added together and compared to the criteria for 2,3,7,8- tetrachlorodibenzo-p-dioxin.
Highlighted cells = lowest applicable criteria
Source: Non-Residential Part 201 Generic Cleanup Criteria and Screening Levels; Part 213 Tier 1 Risk-Based Screening Levels, document release date March 25, 2011.

TABLE 3

Summary of VOCs, SVOCs, Pesticides, PCDD/PCDF, and Inorganic Exceedances

OU1 Feasibility Study Report—Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund site

Analyte	Surface Soils	Subsurface Soils	Surface Sediments	Subsurface Sediments	Groundwater[a]	Seeps[a]
VOCs						
Carbon Tetrachloride		1/54				
Acetone			1/2			
SVOCs						
Acenaphthene			1/2			
Carbazole			1/2			
Dibenzofuran			1/2			
Phenanthrene		1/54				
4-methylphenol		12/54				
Naphthalene		1/54	1/2			
Pentachlorophenol		1/54	1/2			
Pesticides						
None						
PCDD/PCDF[b]						
Total TCDD Equivalent	1/8					
Inorganics						
Aluminum	1/2	26/55			5/72	1/37
Antimony		7/55				
Arsenic	1/2	9/54	1/2		23/72	10/37
Barium		23/55	1/2	1/1	4/72	4/37
Cadmium		5/55				
Chromium	2/2	53/55	2/2	1/1	1/72	
Cobalt		6/55				
Copper		23/55		1/1		
Cyanide		21/54			4/72	3/37
Iron	1/2	8/55	1/2	1/1	64/72	31/37
Lead	1/2	20/55	1/2	1/1	1/72	
Magnesium		13/55				
Manganese		4/55			66/72	36/37
Mercury		20/55		1/1		
Nickel		1/55		1/1	4/72	1/37
Selenium		10/55	1/2	1/1		
Silver				1/1	2/72	
Sodium					4/72	
Vanadium					1/72	1/37
Zinc		28/45	1/2	1/1	7/72	

Note:
x/y = number of samples (x) exceeding screening level criteria out of number of samples (y)
[a] Only the data from the 2002/2003 groundwater and seep samples are summarized to reflect conditions after removal
[b] Dioxin and furans only sampled in surface soils in 1998
PCDD = polychlorinated dibenzodioxins, PCDF = polychlorinated dibenzofurans

TABLE 4
Summary of Short-term Effectiveness Considerations
Allied Landfill—Allied Paper, Inc. / Portage Creek / Kalamazoo River Superfund site

Alternative	Total Area Addressed	Total Volume of COC-Containing Materials Excavated	Duration	Worker Risks	Community Impacts
Alternative 1	No areas addressed	No volume of impacted PCB-containing materials addressed	No time period to implement	No worker risks from implementation as no action is taken.	Potential offsite migration of COC-containing materials.
Alternative 2A	42 acres	316,000 yd^3	Approximately 2 years	Least of the active alternatives; managed by health and safety plan.	Associated with dust, noise, and truck traffic.
Alternative 2B	42 acres	486,000 yd^3	Approximately 2 years	Slightly increased due to moving Monarch HRDL; managed by health and safety plan.	Slight increase; associated with dust, noise, and truck traffic.
Alternative 2C	42 acres	486,000 yd^3	Approximately 2 years	Greater than 2A and 2B due to potential exposure during characterization and transportation.	Greater than 2A and 2B due to additional management for characterization and offsite transport.
Alternative 3	52 acres	1,575,500 yd^3	5 years	Greater than Alternative 2 given the area/volume of targeted material; Increased travel for disposal and increased project duration.	Greater than Alternative 2; associated with noise, dust, and particularly increased truck traffic, which would average 40 trips daily in and out of Allied Landfill for the duration of the project. Greatest number of miles driven due to volume transported to disposal facilities with limited locations.
Alternative 4	52 acres	1,575,500 yd^3	10 years	Greater than Alternatives 2 and 3 given the area/volume of targeted material and significantly increased project duration.	Greater than Alternatives 2 and 3; associated with noise and dust over the longest project duration. Slightly more truck trips than Alternative 3, but 1/3 of the miles outside Allied Landfill due to decreased volume transported to disposal facilities.

TABLE 56

Comparative Analysis of Alternatives

Allied Landfill—*Allied Paper, Inc. / Portage Creek / Kalamazoo River Superfund site*

Alternative	Description	Overall Protection	Compliance with ARARs	Long-term Effectiveness	Reduction of Toxicity, Mobility or Volume through Treatment	Short-term Effectiveness	Implementability	Cost
Alternative 1	**No action**	Not protective. No action would be taken.	Would not meet ARARs	Not effective. Site conditions would remain the same.	No reduction of toxicity, mobility, or volume.	No worker risks. No action to be taken.	Implementable as no action would be taken.	$120,000
Alternative 2	**Consolidation and capping**							
2A	Construct caps on both Monarch and Former Operational Areas	Protective. Remaining exposed contamination would be covered and contained. Infiltration of surface water would be minimized.	Meets ARARS.	Effective.	No reduction of toxicity, mobility, or volume would be achieved.	Implementation over 2-year period, most effective of active alternatives. Worker risk associated with dermal contact, inhalation, and ingestion. Risks are controllable. Community impacts associated dust, noise, and traffic.	Proven technology that has been implemented at similar OUs.	$43 million
2B	Consolidate Monarch within Former Operational Areas	Protective. Remaining exposed contamination would be covered and contained. Consolidation of the Monarch HRDL within the Former Operational Areas would reduce the amount of monitoring required.	Meets ARARS.	Effective.	No reduction of toxicity, mobility, or volume would be achieved.	Implementation over 2-year period, slightly longer than 2A. Worker risk associated with dermal contact, inhalation, and ingestion. Risks are controllable. Community impacts associated dust, noise, and traffic.	Proven technology that has been implemented at similar OUs. Combining Monarch on the Former Operational Areas would reduce the footprint of contamination.	$41 million
2C	Consolidate Monarch within Former Operational Areas and transport excavated soils with PCBs >500 mg/kg offsite for incineration	Protective. Remaining exposed contamination would be covered and contained. Consolidation of the Monarch HRDL within the Former Operational Areas would reduce the amount of monitoring required. Offsite incineration of some of the highest PCB concentrations would be slightly more protective.	Meets ARARs	Effective.	Reduction of toxicity and volume through treatment of a portion of the material.	Implementation over 2-year period, slightly longer than 2A and 2B. Worker risk associated with dermal contact, inhalation, and ingestion due to increased management with characterization and segregation. Risks are controllable. Community impacts associated dust, noise, traffic, and offsite transportation of contaminated materials.	Proven technology that has been implemented at similar OUs. Combining Monarch on the Former Operational Areas would reduce the footprint of contamination. TSCA-permitted incinerators are limited quantity. Identifying, segregating and shipping, make 2C more difficult to implement.	$62 million
Subalternative (i)	Groundwater collection and treatment system	Protective. Achieves RAO 3 with collection and treatment of potentially impacted groundwater.	Meets ARARs	Effective.	Provides some reduction of volume through treatment of PCBs in groundwater. However, minimal contaminant mass is present in the groundwater.	Manageable risk associated with the installation of wells and construction of treatment system.	Proven technology.	$4.6 million (2A) or $4.5 million (2B and 2C)
Subalternative (ii)	Groundwater collection and treatment system with slurry wall	Achieves RAO 3 with collection and treatment of potentially impacted groundwater, but may create mounding or otherwise alter groundwater flow.	Meets ARARs	Effective.	Provides some reduction of volume through treatment of PCBs in groundwater. However, minimal contaminant mass is present in the groundwater.	Increased short-term risks to construction worker and environment over subalternative (i) during installation of the slurry wall. Community impacts from dust, noise and traffic associated with the slurry wall construction.	Proven technology. Implementation may result in groundwater mounding or short-circuiting around the barrier if operation of the groundwater treatment system ceased.	$13 million (2A) or $12 million (2B and 2C)

TABLE 56

Comparative Analysis of Alternatives

Allied Landfill—*Allied Paper, Inc. / Portage Creek / Kalamazoo River Superfund site*

Alternative	Description	Overall Protection	Compliance with ARARs	Long-term Effectiveness	Reduction of Toxicity, Mobility or Volume through Treatment	Short-term Effectiveness	Implementability	Cost
Alternative 3	**Total Removal and Offsite Disposal**	Protective. Contamination would be disposed of at an approved landfill facility both hazardous and non-hazardous.	Meets ARARS.	More effective than Alternative 2 due to removal from OU1. No cover maintenance or source for potential groundwater impacts.	No reduction of toxicity, mobility, or volume would be achieved. Volume may be increased if soils require dewatering by addition of cement.	Implementation over 5-year period. Worker risk associated with dermal contact, inhalation and ingestion would occur over a longer period of time. Risks are controllable. Community impacts associated dust, noise, and traffic.	Proven technology, landfill space in the area could be limited requiring the hauling of waste a significant distance from OU1.	$189 million
Alternative 4	**Encapsulation Containment System**	Protective. Little advantage achieved by construction of the liner. Compacted waste can achieve 1×10^{-7} centimeters per second hydraulic conductivity on its own limiting groundwater flow through the material.	Meets ARARS.	More effective than Alternative 2. The source material is fully encapsulated further minimizing potential for groundwater impacts.	No reduction of toxicity, mobility, or volume would be achieved.	Implementation over 10-year period. Worker risk associated with dermal contact, inhalation, and ingestion would occur over a longer period of time. Risks are controllable. Community impacts associated dust, noise is the least short-term effective alternative.	Proven technology.	$136 million

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